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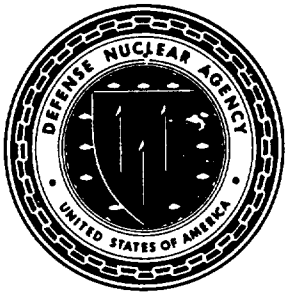

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Global Proliferation—Dynamics, Acquisition Strategies, and Responses
Volume 2—Nuclear Proliferation

Lewis A. Dunn, et al.
Science Applications Intl Corp
P.O. Box 1303
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13. ABSTRACT *(Maximum 200 words)*

The proliferation of nuclear weapons, as well as their associated missile delivery systems, is increasingly acknowledged to be one of the most important threats to U.S. security and global stability in the emerging post-Cold War world. Prepared for the Defense Nuclear Agency (DNA), this report:

a. Assesses the current proliferation situation, including incentives and disincentives for acquisition, current outcomes, and future trends.

b. Highlights different weapons acquisition strategies that countries have pursued and continue to pursue.

c. Describes current policies to contain, cap or rollback, or deal with proliferation.

d. Identifies key policy challenges as well as new initiatives to help strengthen U.S. efforts.

e. Identifies areas in which the Department of Defense (DoD) may be able to make significant contributions to U.S. nonproliferation efforts.

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SUMMARY

The proliferation of nuclear weapons -- as well as their associated delivery systems -- is one of the main post-Cold War threats to U.S. security. Actions are underway to buttress U.S. policies to check, cap or roll back, or respond to this proliferation. High level attention also is now being focused on the defense planning implications of proliferation.

The Department of Defense (DoD) can provide significant "value added" contributions to future U.S. nonproliferation efforts. Two sets of potential DoD activities stand out: (1) program support to specific U.S. nuclear nonproliferation initiatives; and (2) responsibility for execution of certain broad counterproliferation missions.

Specific DoD Nonproliferation Support

Building on its core competencies, expertise, and established programs or activities, DoD's technical and intelligence programs can support a wide range of current or future counter-proliferation policy initiatives. Augmented DoD responsibilities in some of these areas, moreover, would foster more efficient use of available resources and compensate for shrinking Services' capabilities. In thinking about specific DoD activities, both contributions before proliferation occurs and responses to actual proliferation need to be considered.

Areas in which DoD has a role in carrying out initiatives to check, cap, or rollback nuclear proliferation include:

- RDT&E of treaty verification technologies;
- Application of proliferation-related databases to implementation of export controls;
- Accelerated RDT&E of nonproliferation technologies;
- Implementation of security assurances and provision of protective assistance;
- More extensive use of military-to-military contacts to influence countries' proliferation incentives;
- Increased sharing of proliferation intelligence; and
- Contingency planning for active measures to block proliferation.

Possible DoD roles in responding to nuclear proliferation include:

- Updating of region-specific intelligence and threat assessments;
- Increased analytic support on regional proliferation developments;
- Preparation for emergency responses to proliferation crises;
- Planning for a broad range of nuclear options and potential deployments;
- Continued RDT&E on enhanced defenses and protective measures;
- Contingency planning for deterrence and preemption against hostile new proliferators; and
- Coordination of technology sharing for reduced proliferation risk.

Organization of the Report

This report comprises six separable Volumes (with appendices), of which this volume on nuclear proliferation is one. Volume I, the Overview, provides a summary of the report. Prepared as stand-alone documents, each subsequent volume addresses a particular counter-proliferation area: nuclear, chemical, and biological weapons, missiles, and conventional weapons, respectively. The discussion in each of these volumes provides a detailed analysis of the proliferation situation, the weapons acquisition process, U.S. counterproliferation efforts, and some possible roles for DoD. Supporting information and supplementary materials are included as appendices to each Volume. The appendices also provide information on the U.S. government policy process and key organizational participants in that process.

PREFACE

This report was prepared for the Defense Nuclear Agency (DNA) under contract number DNA 001-93-C-0083 under the auspices of the Center for Verification Research, and supervised by Ms. Cathie Montie. The Principal Investigator for this effort was Dr. Lewis A. Dunn.

The authors which to express their appreciation to the many analysts and technical support personnel who were instrumental in the publication of this report. Special thanks are due to Marvin Atkins, Joel Bengston, Richard Blumstein, John Bulger, James Bushong, Burrus Carnahan, Alexis Castor, Emerory Chase, Edward Chaves, Catherine Coleman, Denis Dwyer, Wendy Gourdeau, Richard McNally, Malcom Morrison, Timothy Pounds, John Ricca, Jacqueline Smith, Richard Soll, Sharon Squassoni, and Michael Yap for their helpful comments and insights.

Science Applications International Corporation has produced a number of related studies and analytical reports that provided a foundation for this effort. This report evolved from earlier editions that examined possible roles for the Defense Nuclear Agency in a proliferating world. The effort was expanded to cover Department of Defense roles and was published in a coordination draft form in April, 1993. This effort has attempted to incorporate policies derived from the current administration as extracted from the public record. The information cut off date is 1 September, 1993.

CONVERSION TABLE

Conversion factors for U.S. Customary to metric (SI) units of measurement.

MULTIPLY ----------▶ TO GET ◀----------	BY ----------▶ BY ◀----------	TO GET ----------▶ DIVIDE
angstrom	1.000 000 X E -10	meters (m)
atmosphere (normal)	1.013 25 X E +2	kilo pascal (kPa)
bar	1.000 000 X E +2	kilo pascal (kPa)
barn	1.000 000 X E -28	meter^2 (m^2)
British thermal unit (thermochemical)	1.054 350 X E +3	joule (J)
calorie (thermochemical)	4.184 000	joule (J)
cal (thermochemical/cm^2)	4.184 000 X E -2	mega joule/m^2 (MJ/m^2)
curie	3.700 000 X E +1	*giga becquerel (GBq)
degree (angle)	1.745 329 X E -2	radian (rad)
degree Fahrenheit	t_k = (t°f + 459.67)/1.8	degree kelvin (K)
electron volt	1.602 19 X E -19	joule (J)
erg	1.000 000 X E -7	joule (J)
erg/second	1.000 000 X E -7	watt (W)
foot	3.048 000 X E -1	meter (m)
foot-pound-force	1.355 818	joule (J)
gallon (U.S. liquid)	3.785 412 X E -3	meter^3 (m^3)
inch	2.540 000 X E -2	meter (m)
jerk	1.000 000 X E +9	joule (J)
joule/kilogram (J/kg) radiation dose absorbed	1.000 000	Gray (Gy)
kilotons	4.183	terajoules
kip (1000 lbf)	4.448 222 X E +3	newton (N)
kip/inch^2 (ksi)	6.894 757 X E +3	kilo pascal (kPa)
ktap	1.000 000 X E +2	newton-second/m^2 (N-s/m^2)
micron	1.000 000 X E -6	meter (m)
mil	2.540 000 X E -5	meter (m)
mile (international)	1.609 344 X E +3	meter (m)
ounce	2.834 952 X E -2	kilogram (kg)
pound-force (lbs avoirdupois)	4.448 222	newton (N)
pound-force inch	1.129 848 X E -1	newton-meter (N·m)
pound-force/inch	1.751 268 X E +2	newton/meter (N/m)
pound-force/foot^2	4.788 026 X E -2	kilo pascal (kPa)
pound-force/inch^2 (psi)	6.894 757	kilo pascal (kPa)
pound-mass (lbm avoirdupois)	4.535 924 X E -1	kilogram (kg)
pound-mass-foot^2 (moment of inertia)	4.214 011 X E -2	kilogram-meter^2 (kg·m^2)
pound-mass/foot^3	1.601 846 X E +1	kilogram/meter^3 (kg/m^3)
rad (radiation dose absorbed)	1.000 000 X E -2	**Gray (Gy)
roentgen	2.579 760 X E -4	coulomb/kilogram (C/kg)
shake	1.000 000 X E -8	second (s)
slug	1.459 390 X E +1	kilogram (kg)
torr (mm Hg, 0° C)	1.333 22 X E -1	kilo pascal (kPa)

*The becquerel (Bq) is the SI unit of radioactivity; 1 Bq = 1 event/s.

**The Gray (GY) is the SI unit of absorbed radiation.

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SECTION 1

THE PROLIFERATION SITUATION

1.1 INTRODUCTION.

Since the end of World War II almost half a century ago, there has been a gradual but continuing proliferation of nuclear weapons around the globe. The U.S. monopoly of nuclear weapons lasted only four years, broken more quickly than many experts expected by the Soviet atom bomb test in 1949. By 1964, there were only five acknowledged nuclear weapons states (the United States, the Soviet Union, the United Kingdom, France, and China). To many persons' surprise, that number of acknowledged nuclear powers has not subsequently increased.

A new set of unacknowledged emerging nuclear weapons states (India, Israel, and Pakistan) has, however, come into being. In 1991, the breakup of the Soviet Union created yet another new group of countries, the potential inheritors (Belarus, Kazakhstan, and Ukraine), that still have some former Soviet nuclear weapons on their territories, despite their declared intentions of ultimately getting rid of them.[1] In addition to the unacknowledged emerging nuclear weapons states and these potential nuclear inheritors, the nuclear proliferation problem today concerns a larger group of aspiring proliferators that have made varying amounts of progress toward their apparent goal of acquiring nuclear weapons. Continuing attention must also be paid to several countries (Argentina, Brazil, and South Africa) that recently renounced the nuclear weapons option, apparently beginning a process of nuclear rollback.

To provide a more detailed understanding of the present nuclear proliferation situation, this section examines the incentives and disincentives that influence nations in deciding whether or not to seek nuclear weapons capabilities, describes the kinds of nuclear proliferation outcomes which exist today, and assesses current proliferation trends and prospects. It concludes with a brief analysis of the security consequences of proliferation.

1.2 INCENTIVES AND DISINCENTIVES.

On the basis of past experience, military considerations are the dominant incentive for acquiring nuclear weapons, but political and economic incentives are also sometimes present. A highly-motivated personality at the top of a nuclear weapons program can also be critical to driving it ahead. At other times, bureaucratic and scientific momentum may fuel steady advances in already established nuclear weapons-related activities. On the disincentives side,

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[1]Russia possesses most of the former Soviet nuclear arsenal and has inherited the position of the Soviet Union as one of five acknowledged nuclear weapons states.

military considerations are again important, but less likely to be dominant. Political and economic disincentives are often quite influential, and the steady growth of a norm of non-proliferation within the international nonproliferation regime provides additional strong disincentives. (See Table 1-1 for lists of nuclear proliferation incentives and disincentives.)

Table 1-1. Nuclear proliferation incentives and disincentives.

INCENTIVES	DISINCENTIVES
Military	**Military, Fear of:**
• Deterrence: - Nuclear Threat - Conventional Threat • War-Fighting - Weapons of Last Resort	• Provoking Nuclear Attack • Disrupting Relations with Allies
Political	**Political**
• Improve International Status • Domestic Prestige • Bureaucratic & Scientific Pressure	• Damage to International Standing • Popular Anti-nuclear Sentiment
Economic	**Economic**
• Reduces Spending on Conventional Forces	• Cost of Nuclear Weapons and Delivery Systems • Impediment to Foreign Aid and Investment • Diversion of Resources from Conventional Forces
	Non-Proliferation Regime
	• Political Cost of Violating Nonproliferation Norms • Safeguards • Export Controls on Items Needed for Civilian Nuclear Power Programs

1.2.1 Incentives.

The military reasons for seeking nuclear weapons capabilities have varied, and must often be deduced largely from circumstantial evidence. At the start of the nuclear age, the United

States launched the Manhattan Project because of fear that Germany would develop nuclear weapons first and use them to win the war and dominate the world. After Germany's surrender, pursuit of a decisive weapon to end the war in the Pacific was an important motive. The Soviet Union developed nuclear weapons in part to deter the United States from gaining military or political advantage from its nuclear monopoly and in part because Stalin recognized the awesome potential power of nuclear weapons. The Swedish military for a time in the 1950s saw nuclear weapons playing a role in deterring or defeating a Soviet conventional attack.

1.2.1.1 Regional Deterrence and Global Influence. Deterring regional rivals has been a critical incentive for more recent proliferation, particularly on the part of the unacknowledged nuclear powers. Israel is widely believed, for example, to have set out to acquire nuclear weapons in the mid-1950s to provide it with a last resort deterrent should the far larger conventional armies of its Arab enemies threaten to overrun it. Pakistan has sought nuclear weapons to counter, and if possible deter, the threat from India's more powerful conventional forces. In both cases, this search for a nuclear equalizer reflected deeper political and religious animosities and past experience of military conflict.

Military incentives are sometimes accompanied by political incentives. Among the acknowledged nuclear powers, France and the United Kingdom (especially France) wanted independent nuclear deterrents of the Soviet Union; but they also wanted to bolster their accustomed status as great powers and regarded nuclear weapons as an important means of achieving that goal. India is another example of a mixture of military and political motives in conducting its weapons-related nuclear program. Initially, it sought to counter China's nuclear capabilities, and later it added the objective of deterring the possible future use of nuclear weapons by Pakistan. In addition, however, the government of India was interested in improving its international standing, both regionally and globally, increasing its domestic prestige, and responding to bureaucratic and scientific pressure in support of a nuclear weapons program.

1.2.1.2 Domestic Considerations. The economic incentive of reducing spending on conventional forces may also influence the decisions of some governments to seek nuclear weapons capabilities. In the future, for instance, this could reinforce pressures on Israel to move to more open nuclear deployments. Strong personalities have frequently been critical to successful nuclear weapons programs: Leslie Groves and Robert Oppenheimer in the U.S. Manhattan Project; Homi Bhabha in the early years of India's nuclear program; A.Q. Khan in Pakistan's successful push for a weapons capability; and Ali Jaffar in Iraq are among the publicly well-known examples.

1.2.2 Disincentives.

1.2.2.1 Fear of Military Attack or Insecurity. A country may decide not to acquire nuclear weapons because of fear of provoking a preemptive attack by a nuclear-armed adversary or disrupting relations with an important ally. Thus, the Swedish military shifted from favoring nuclear weapons as a means of keeping the Soviet Union from concentrating its conventional

forces in an invasion of Sweden to concluding that even possessing nuclear weapons might stimulate a devastating Soviet nuclear attack on Sweden's cities in the event of war in Europe. South Korea appears to have given up an incipient nuclear weapons program in the mid-1970's when it became convinced that going ahead would have disrupted its alliance with the United States and weakened its security.

The impact of such concerns, however, may vary widely. For some more recent aspiring proliferators, e.g., Saddam Hussein's Iraq, the lesson drawn may be quite different. Israel's successful 1981 attack on Iraq's Osirak research reactor stimulated the dispersal, concealment, and diversification of that country's nuclear weapons program, not its termination.

1.2.2.2 Political Considerations. Both international and domestic political considerations may inhibit the acquisition of nuclear weapons. Even if it had not renounced nuclear weapons in several international agreements, Germany would be unlikely to arm itself with such weapons because of the damage that this action would do to its international standing. Japan is similarly restrained by the predictable negative reactions of other nations -- especially those that it invaded before and during World War II -- to its acquisition of nuclear weapons. The Japanese government is also restrained by the strong anti-nuclear sentiments of the Japanese people, dating from the destruction of Hiroshima and Nagasaki by atomic bombs at the end of World War II. Even a sharp division of domestic opinion can block a decision on nuclear weapons, as occurred in Sweden in the 1950's and 1960's.

1.2.2.3 Economic Costs and Risks. For more economically hard-pressed countries, the perceived cost of developing nuclear weapons, and even more the cost of acquiring modern delivery systems for such weapons, may be another disincentive to seeking nuclear weapons capabilities. The effect of these costs can easily be overestimated, however. Some delivery system might be acquired anyway for conventional weapons, and some of the cost of developing the weapons themselves can plausibly be attributed to civil nuclear energy programs.

In some circumstances, a more powerful economic disincentive is the fear that seeking a nuclear weapons capability will make it more difficult to obtain badly needed foreign aid and investment. This disincentive may be operating on India and Pakistan today, although it is not yet strong enough to induce them to abandon their weapons-related nuclear programs. Reluctance to divert resources from conventional forces in order to finance the development of nuclear weapons can be another economic disincentive, especially if a traditional military officer corps sees the eventual deployment of nuclear armed forces as a threat to its own power and prestige.

1.2.2.4 Strong Global Norms. The international nuclear nonproliferation regime provides several important disincentives to acquiring nuclear weapons. The nonproliferation norms on which the regime rests, and which it helps to propagate, make seeking nuclear weapons capabilities less acceptable or respectable, even for countries that have avoided joining the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) or the Treaty of Tlatelolco

creating a Latin American nuclear-weapon free zone. Members of these treaties are not only legally committed not to acquire nuclear weapons, but they are required to put their peaceful nuclear facilities under safeguards, including on-site inspections administered by the International Atomic Energy Agency (IAEA). In addition, many members of the NPT impose export controls on items needed in nuclear weapons programs.

1.3 CURRENT PROLIFERATION OUTCOMES.

The four acknowledged nuclear weapons states (in addition to the United States) can be thought of as old proliferation outcomes with one exception: the potential fragmentation of the nuclear weapons capability of the former Soviet Union. Today's nuclear proliferation outcomes relate to the capabilities of the unacknowledged emerging nuclear weapons states, the aspiring proliferators, the potential inheritors, and the rollback cases. The proliferation process is continuing, but with some important differences from the first three decades of the nuclear age.

1.3.1 The Unacknowledged Emerging Nuclear Weapons States.

The most important of those differences is the failure of the emerging nuclear weapons states to acknowledge either their pursuit or their possession of nuclear weapons. Tel Aviv has stuck by its public posture that Israel "would not be the first to introduce nuclear weapons into the Middle East," although Israel is widely believed to have a fully developed nuclear arsenal. India and Pakistan have followed Israel's lead of non-acknowledgement. But both countries are believed to have produced the components of nuclear weapons, including weapons-grade fissile material, and to be able to assemble nuclear weapons on very short notice. India did assemble and explode a nuclear device in 1974, claiming, however, that this was only a "peaceful nuclear explosion."

Capabilities among today's unacknowledged nuclear powers vary widely in terms of numbers of warheads, their sophistication, and means of delivery. For example, Israel is frequently assumed by outside analysts to have a fairly substantial nuclear arsenal, including more advanced nuclear weapons. By contrast, Pakistan and India appear to remain emerging nuclear powers, characterized by still limited capabilities to assemble rapidly first generation fission weapons. All three countries possess nuclear-capable modern aircraft. Israel has deployed nuclear-capable ballistic missiles and India is expected to do so shortly. Pakistan is to acquire or develop such missiles.

With regard to doctrine and strategy -- what nuclear threats might be made, what targets might be struck, and under what circumstances -- extremely little is known about the thinking of the unacknowledged nuclear powers. Procedures for nuclear command and control, for nuclear weapons safety and security, and for handling the many other aspects of managing a new nuclear force also remain open but important questions.

1.3.2 Aspiring Proliferators.

Around the globe, still other countries have displayed some or even considerable interest in acquiring nuclear weapons (which they do not acknowledge), but have not advanced far enough to be considered emerging nuclear weapons states. Here, too, however, there is a range of programs broadly distinguished by how close particular countries are to acquiring a basic nuclear weapons capability. There is also often a good deal of uncertainty about these countries' ultimate intentions.

Iraq and North Korea, for instance, can be regarded as threshold nuclear weapons states, in that they appear to have reached or closely approached the capability of producing fissile material for weapons. Iraq has of course been set back by the efforts of the U.N. Special Commission to dismantle its facilities for developing and making weapons of mass destruction. What will happen to North Korea's nuclear program as the result of international pressure, including the referral of the problem to the U.N. Security Council, remains to be seen.

Other potential aspiring proliferators (Algeria, Libya, Syria, and Iran) are far behind the threshold countries. Their efforts are still focused essentially on putting in place a basic nuclear infrastructure, building up scientific talent and know-how, and exploring their options. This set of aspiring proliferators has both expanded and contracted over time. Taiwan and South Korea, were high on lists of proliferation problem countries in the mid-1970s and could conceivably become problems again in the future. Syria and Algeria are new countries of concern. Additional aspiring proliferators could appear in the future.

1.3.3 Potential Inheritors.

The collapse of the former Soviet Union has created a group of potential nuclear inheritors. When the Soviet Union ceased to exist in December 1991, the Soviet arsenal of nuclear weapons was principally in Russia, but substantial numbers of both strategic and tactical nuclear weapons were also deployed in Belarus, Kazakhstan, and Ukraine. By arrangement between the republics, all tactical nuclear weapons reportedly have now been moved to Russia. Russia has also claimed to be the successor of the Soviet Union as a nuclear weapons state and joined the NPT in that capacity. Several hundred former Soviet strategic nuclear weapons (361 ICBMs and 70 heavy bombers) remain deployed in the three non-Russian republics, under the of the military command of the Commonwealth of Independent States (CIS).

Kiev and Alma-Ata have still not taken any steps to implement their May 1992 commitment to join the NPT as non-nuclear weapons states "in the shortest possible time."[2] Questions also have arisen about their readiness to live up to their leaders' pledges -- made in legally binding letters to President Bush -- to eliminate all nuclear weapons and all strategic

[2]Belarus acceded to the NPT as a non-nuclear weapon state on July 22, 1993.

offensive arms from their territories within seven years from the entry into force of the START agreement. Instead, there are signs, especially in Ukraine, that a new form of nuclear ambiguity may be emerging: promise to give up former Soviet nuclear weapons, but seek to retain them for political leverage and insurance.

1.3.4 Nuclear Rollback Cases.

During the first decades of the nuclear era, as already noted, several countries initiated efforts toward acquisition of a nuclear weapons option and then did not proceed further. Recently, several cases of apparent nuclear rollback -- the voluntary and credible renunciation of efforts to move closer to a nuclear weapons capability -- have occurred.

In November 1990, the presidents of Argentina and Brazil agreed that their countries would eventually bring the Treaty of Tlatelolco into full force, which would have the effect of excluding nuclear weapons from their territories. A year later, the two countries signed an agreement with the IAEA to put all their nuclear facilities under IAEA safeguards. After years of resisting international pressure to join the NPT, South Africa did so on July 10, 1991. On September 16, 1991, a safeguards agreement with the IAEA went into effect.

Among the rollback countries, only South Africa is known to have manufactured nuclear weapons. South Africa had produced weapons-grade enriched uranium and announced its capability to manufacture a nuclear weapon. Some questions and uncertainties still remain about the sustainability of nuclear rollback. Brazil has not yet brought the Treaty of Tlatelolco into full force or ratified the agreement with the IAEA. Ratification of the agreement is stuck in the Brazilian Congress, largely because of the concern of members over its regional inspection provisions.[3] Questions still remain regarding South Africa's past nuclear activities. But overall, recent rollback cases belie the oft-encountered assumption that, once begun, the process of nuclear weapons acquisition is irreversible.

1.4 PROLIFERATION TRENDS AND PROSPECTS.

Considerable uncertainty surrounds near-term (3-5 years) nuclear proliferation trends in current areas of concern. Prospects range from all but certain continued incremental advances by the unacknowledged nuclear powers and aspiring proliferators to less likely but not precluded nuclear breakout in one or more regions. A number of possible proliferation surprises could have an especially important impact on what transpires.

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[3]Argentina has ratified the agreement with the IAEA, but will not implement it until Brazil also ratifies it. The Argentine Congress is in the process of ratifying the Treaty of Tlatelolco.

1.4.1 Incremental Nuclear Advances.

Both the unacknowledged nuclear powers and the aspiring nuclear powers are likely to continue and perhaps diversify their activities. This would encompass, for example, further growth of Israel's nuclear arsenal as well as production of more nuclear weapons materials by India and Pakistan. India may also begin to enrich uranium (possibly producing HEU). Whether, and if so, how many nuclear weapons either country would assemble is uncertain.

Similarly, though unlikely to produce nuclear weapons in the next few years, the current programs of proliferation problem countries in the Middle East and North Africa are also likely to move ahead. At least under its present leadership, for example, Iraq will try to revive its nuclear weapons program when if it is able to escape from the surveillance of the U.N. Special Commission. Iran will continue to recreate the weapons-related program that collapsed after the overthrow of the Shah. Algeria, Libya, and Syria can be expected to maintain and possibly expand their modest nuclear research programs.

1.4.2 Ups and Downs in Capping or Rolling Back Proliferation.

Though modest incremental advances are perhaps the most likely prospect, further successes in capping or even rolling back proliferation are possible. For instance, Israel could choose to cease plutonium production at Dimona. This step might be taken unilaterally to provide greater political legitimacy for more coercive measures to head-off Iraqi or Iranian nuclear weapons programs; it also is conceivable as part of an international effort to induce other states in the region to defer or slow down efforts to acquire nuclear weapons. Israel would be more likely to agree to cap its nuclear activities, and some of its neighbors would be more likely to respond appropriately, if progress were being made in the Arab-Israeli peace talks.

Elsewhere, steps might be possible toward negotiation of an India-Pakistan nuclear standstill, reflecting both countries' interest in avoiding an all-out regional nuclear arms race. North Korea could permit the inspection of its nuclear facilities by South Korea, as well as the IAEA, and dismantle its partly completed reprocessing plant, and in effect become a rollback case in process. As time passes with little or no progress, however, this kind of happy outcome becomes less and less likely.

But there also are dangers that nuclear rollback where it currently is underway could stall. Domestic considerations again would be the driver. Political disarray in Brazil already is threatening the process; overthrow of the present South African government by more nationalist leaders could lead to revision of the decision to join the NPT.

1.4.3 Nuclear Breakout.

One of the distinguishing characteristics of the current proliferation situation is the decision by emerging nuclear powers not to acknowledge their capability. Non-acknowledgement has been politically valuable for these countries, helping to avoid or reduce adverse regional and

international reactions. However, nuclear breakout -- the open deployment of nuclear weapons and more intense nuclear arms competition -- is a possible but not likely development in several regions.

In particular, a crisis between India and Pakistan (most likely over Kashmir) could cause both nations to assemble nuclear weapons and deploy small nuclear armed forces (aircraft and missiles in India and probably aircraft alone in Pakistan). A nuclear explosive test could be conducted by either India or Pakistan or both. More likely than not, the result would be an expanding nuclear arms race, fueled by worst case calculations, domestic political pressures, and South Asian versions of the early 1980s U.S.-debate about a "window of vulnerability."

There is another source of potential nuclear breakout in the coming decade: Ukraine, followed by Kazakhstan, could claim its nuclear inheritance and fail to honor its commitments to eliminate the remaining former Soviet nuclear weapons on its territory. A great deal may depend on domestic political and economic developments in Russia and the other new nations, as well as between them.

Less likely but also a cause for concern: one or more nuclear weapons from the stockpile of the former Soviet Union could be diverted and sold to a country in the Middle East. This would radically shift the regional military equation. Israel could well move to open testing of nuclear weapons and develop advanced thermonuclear designs in order to signal its superiority and reassure its own public.

Efforts by the United States and other countries to induce North Korea to terminate its nuclear weapons could fail, and North Korea could produce some nuclear weapons a few years from now. In that event, South Korea and Japan would reconsider, and might reverse, their present policies of not acquiring such weapons.

1.4.4 New Aspiring Proliferators.

Still other countries could decide to pursue a nuclear weapons capability, joining the current set of aspiring proliferators. Should North Korea continue its efforts to develop nuclear weapons, South Korea could begin work on a dedicated plutonium production reactor and a pilot reprocessing plant. Either development would trigger a debate in Japan over whether it should acquire nuclear weapons to protect itself from the prospect of such weapons in one or both Koreas.

In other regions, domestic and regional changes, including revival of Iraqi and Iranian nuclear weapons programs, could lead Egypt and Turkey to reexamine their traditional non-nuclear status. While it appears unlikely that any of the non-Russian former Soviet republics would launch indigenous nuclear weapons programs, this, too, is not precluded in the event of further political and economic discord among them. Moreover, should Ukraine decide to keep the nuclear weapons in its territory, other countries, such as Poland, could reconsider their non-nuclear status.

1.4.5 Proliferation Surprises and Critical Events.

There are many possible surprises and critical events that could affect significantly the scope, pace, and characteristics of proliferation over the coming decade. Summarized in Table 1-2, on the next page, the occurrence of several but not all of these surprises or developments would accelerate proliferation. Failure to extend the NPT for more than a nominal period of 5-10 years, collapse of U.N. inspections in Iraq, the end of rollback in South America, and a succession crisis in China that leads to that country's de facto fragmentation and loss of control over nuclear weapons are four examples. Other developments, perhaps best typified by progress in the Middle East peace process, could have very significant positive effects.

Table 1-2. Some proliferation surprises and critical events.

NEGATIVE	POSITIVE
• NPT Extension for five years only • Collapse of Iraq Inspections • End of rollback in South America or South Africa • Succession crisis in China • India and Pakistan jointly declare nuclear-weapons status • Taiwan or South Korea resumes nuclear program	• Breakthrough in Middle East peace process • Inspection agreement between the Koreas implemented • Japanese decision to put civil plutonium-use on hold • UK decision to give up nuclear weapons • India-Pakistan nuclear standstill

1.4.6 U.S.-Russian Nuclear Build-down.

After four decades of U.S. and Soviet nuclear build-up, there is no doubt that Moscow and Washington have set out on the path to build-down their Cold War nuclear infrastructures and postures. Current agreements will reduce numbers of nuclear warheads by nearly 90%; there is talk of even further reductions to the low hundreds. Planning is underway to take large quantities of Soviet nuclear weapons materials out of the military sector, place them under international safeguards, and eventually dispose of them. Comparable activities with respect to U.S. nuclear weapons materials may not be too far behind. Nuclear testing already is limited and could well be ended.

In effect, the global nuclear context is radically changing. To an even greater degree than previously, acquisition of nuclear weapons is "swimming upstream." Equally important, global nuclear build-down provides the high ground for more active and coercive international actions to block proliferation. This cannot but affect nuclear decision-making and programs in at least some, but not all, of the more important problem countries.

1.5 SECURITY CONSEQUENCES OF NUCLEAR PROLIFERATION.

Even in the near term, with which we are concerned here, several of the nuclear proliferation outcomes just discussed could substantially increase the likelihood or scope of regional conflicts. U.S. and friendly armed forces might confront new threats, as well.

1.5.1 Likelihood and Scope of Conflict.

Nuclear weapons have not been used since Nagasaki. No accidental nuclear explosion has occurred despite many dozens of accidents and incidents involving the nuclear forces of the two superpowers. More widespread proliferation threatens to break down this decades-long nuclear peace.

1.5.1.1 Conventional Military Clashes. Prior to nuclear use, however, actual or anticipated nuclear developments in one country could in some situations precipitate a conventional attack by a neighboring country. The incipient emergence of a nuclear weapons capability in North Korea, for example, could cause South Korea to try to destroy North Korean nuclear weapons production facilities in an attack by conventional armed forces. Or, failure of Belarus, Kazakhstan, or Ukraine to eliminate former Soviet nuclear weapons within the agreed time -- or efforts to take physical control of those weapons -- could conceivably cause Russia to try to seize or destroy them. In such cases, escalation to more extensive military conflict, possibly including the use of nuclear weapons, could then ensue.

1.5.1.2 Unstable Nuclear Arms Racing. Whether in South Asia, the Middle East, or the Korean Peninsula, there are good reasons for concern that future nuclear breakout would lead, not to the emergence of stable nuclear balances of terror, but to very unstable regional nuclear arms competition. On the one hand, many of the political, technical, and situational conditions that led eventually to a stable U.S.-Soviet nuclear relationship are lacking in these regions. For example, the stakes of conflict are very high: political, institutional, and bureaucratic restraints on leaders frequently are weaker; technical capabilities to field safe and secure nuclear weapons are more limited in many instances; and shared borders, multipolar confrontations, and limited time for learning to live with nuclear weapons all provide a very different context for nuclear deployments.

On the other hand, the next nuclear powers may make nuclear force-building choices that, while possibly rational in their own terms, have the effect of increasing the risk of accident, miscalculation, or regional conflict. For instance, emphasis on nuclear readiness could heighten the risk of an accidental nuclear detonation in a crisis or conventional conflict. Also, while deployment of mobile nuclear-armed missiles might enhance survivability, it could also add considerably to the risk of loss of control of nuclear weapons.

1.5.1.3 Use of Nuclear Weapons. In the worst case possibilities, use of nuclear weapons is conceivable -- by accident, miscalculation, or intention. Consider only a few of the dangers in South Asia.

During a crisis or actual conflict between India and Pakistan either country could elect to increase the readiness of its presumed nuclear weapons. The preparation for or actual deployment of these weapons could produce very serious consequences.

Since the intelligence services of both countries no doubt place a high priority on nuclear weapons-related activity, it is likely that the preparation and deployment activities could not be kept secret form the other country for very long. The likely result would be that both countries start to climb the escalation ladder with potentially very serious consequences given the volatile nature of their rivalry.

Perhaps even more dangerous in this scenario is the possibility that, due to lack of prior exercise experience and well-tested operational procedures, a nuclear accident could occur involving an unintended nuclear detonation. In either an uncomplicated deployment or a deployment marred by some sort of accident, the other antagonist could come to the conclusion that a nuclear release was imminent and, rather than take the first blow, elect to initiate a nuclear strike.

In an even more dangerous scenario, were hostilities to break out and escalate to a major conventional conflict, Pakistan's leaders might conclude that using nuclear weapons to stop an Indian conventional offensive is the only way to avoid total defeat. India could, and very likely would, respond with a nuclear attack on targets in Pakistan.

1.5.1.4 Outside Intervention. The use or threatened use of nuclear weapons by one or more parties in an armed conflict could increase the likelihood that an outside power would intervene, thereby widening the scope of the conflict. For example, China might intervene to prevent an Indian victory in a war between India and Pakistan, particularly if India tried to force Pakistan to surrender by threatening to use superior nuclear forces against it. Still another possibility is that Islamic former Soviet republics, including a by-then nuclear-armed Kazakhstan, might intervene in a new Iraq-Iran war to keep Iraq from forcing Iran to surrender by threatening to use nuclear weapons produced after the withdrawal of U.N. surveillance. Similarly, in any confrontation involving Israel and Iran, Iraq, or Libya, that had come into possession of a few stolen or purchased former Soviet nuclear weapons, pressures could be considerable for U.S. involvement -- providing intelligence support, targeting information, and possibly even defensive military forces to support Israeli efforts to overcome its Arab enemies.

1.5.2 Threat to U.S. Forces.

Over the next several years, the most plausible nuclear threat to U.S. forces could arise in Korea. If North Korea produces nuclear weapons, it might threaten to use them against South Korean and U.S. forces in a new effort to unify the Peninsula by force. Less likely, but not precluded, would be new threats to U.S. forces in the Middle East in the event that Iraq, Libya, Iran, or some other potentially hostile nation gains possession of former Soviet nuclear weapons. Over a somewhat longer period, several such countries hostile to U.S.

interests, could well acquire nuclear weapons in their own right. Use of those weapons against U.S. forces -- out of desperation, as a last gamble to deter or end U.S. intervention, or in an act of revenge -- must be considered a real threat.

SECTION 2

THE NUCLEAR PROLIFERATION ACQUISITION PROCESS

2.1 INTRODUCTION.

Since August 6, 1945, all countries have known the single most important technical fact about nuclear weapons: they work. In an explosive chain reaction, it is possible to release the vast quantities of energy in the atom and to inflict awesome destruction on another country's population, industry, and military forces. Two decades later, China's detonation of a nuclear weapon demonstrated that successful pursuit of a nuclear weapons capability need not be limited to advanced industrial countries. For onlookers in the third world, India's 1974 nuclear test reinforced the point that a nuclear capability is within the technical and economic grasp of some developing countries.

Three basic problems confront a country setting out to acquire a minimum, entry-level nuclear weapons capability: mastery of the design principles of fission weapons; development and fabrication of the non-nuclear components needed to trigger an explosive nuclear chain reaction; and acquisition of nuclear-weapons material. Means of delivery must also be identified or acquired. Beyond acquisition of a basic nuclear capability, new nuclear powers confront a series of additional nuclear force-building choices. These range from what security procedures to put in place to what strategy and doctrine to adopt. During both the initial and the more advanced stages of the nuclear weapons acquisition process, some important technical thresholds must be crossed, not least the deployment of secure, survivable second-strike forces.

Of the three basic problems faced in acquiring a minimum, entry-level nuclear weapons production or acquisition of nuclear-weapons material is likely to pose the most difficult challenge. Explosive nuclear testing is not required to field a simple, first-generation fission weapon, though it probably would be a necessary step toward a more advanced nuclear weapons capability.

2.2 COMPONENTS OF A NUCLEAR WEAPONS CAPABILITY.

2.2.1 A Workable Nuclear Weapon Design.

Development of a workable weapon design -- whether for a gun-assembly or an implosion fission device -- is a first critical step. The basic theoretical principles are well-known. Considerable information about the technical details of a basic fission weapon, including the amounts of plutonium or highly enriched uranium needed for an explosive chain reaction, has become publicly available over the past decades. Nuclear "brain-drain" from the former Soviet Union threatens to provide more access to such information to problem countries, as well as a means to check the validity of their own technical calculations and estimates.

2.2.2 Non-Nuclear Components.

Fabrication of the non-nuclear components of a fission warhead includes the manufacture of carefully crafted assemblies of high explosives, electrical firing sets, and arming and fuzing mechanisms. Fairly extensive (but non-nuclear) testing of these non-nuclear components, particularly of the high-explosive lenses for implosion designs, is likely to be required. But there is no reason to expect that proliferation problem countries, from Iraq in the Middle East to North Korea in Asia, would not be able to cross this hurdle successfully. Here, too, considerable information is publicly available. Dual-use components and materials are a valuable source of potential inputs, as exemplified by the availability on the open market of sophisticated high explosives for conventional mining uses, as well as of technical courses in the use of such explosives in mining.

2.2.3 Nuclear Weapons Materials.

Perhaps the most critical step confronting aspiring proliferators, however, is obtaining the needed nuclear weapons materials. Both plutonium-239 (with no more than about 6 or 7 percent Pu-240) and highly enriched uranium (over 90 percent U-235) have been used by the first five acknowledged nuclear powers. For today's problem countries, neither plutonium nor highly enriched uranium stands out as a material of choice. In South Asia, for example, India is on the plutonium route; Pakistan on the uranium road. Pursuit of one or the other of these two nuclear-weapons materials seems most influenced by the ease or difficulty of acquiring the needed production technology and skills. As discussed fully below, a range of possible acquisition routes exists, from dedicated production of highly enriched uranium using gas centrifuge technology to possible theft of former Soviet highly enriched uranium.

2.2.4 Testing and Delivery.

Nuclear explosive testing is not essential for the design and fabrication of a workable fission weapon, even on the part of a developing country. Testing of non-nuclear components, backed by computer modeling, can provide high confidence in the conventional explosion system. In addition, access to test data from other countries, including via brain drain from the former Soviet Union or from another established nuclear power, would further assist making basic design choices.

Delivery systems for nuclear weapons in the early stages of nuclear force development could range from high-performance aircraft and missiles to smuggling a weapon into an enemy's territory. Designing first-generation warheads with size and weight characteristics to fit on the hard point of an advanced aircraft is not necessarily a major problem. However, developing more compact, lighter weight warheads for ballistic missiles could prove troublesome for some problem countries without outside assistance.

2.2.5 Advanced Proliferation Choices.

Most analyses of the nuclear proliferation acquisition process focus only on the steps leading up to acquisition of a basic, fission weapon. But having reached that point, new or emerging nuclear-weapons states -- like the first five acknowledged nuclear powers -- confront a range of additional advanced proliferation or nuclear force-building choices. As illustrated by Table 2-1, these choices concern types, numbers, and characteristics of nuclear warheads; delivery systems; approaches to ensuring survivability; organization and security; and strategy and doctrine.

Table 2-1. Advanced proliferation: choices and outcomes.

Nuclear Materials	Warheads	Delivery Systems	Strategy & Doctrine	Organization & Security	Survivability Approaches
• Plutonium • Highly enriched uranium • Lithium • Tritium • Deuterium	• "Hand-made" fissle weapons • In-flight core insertion • Assembled weapons • Higher yield/wt ratio, smaller size, safer • Initial boosted fission • Selectable/ changeable warheads • Growing numbers	• Bombers • Tactical aircraft • Ships • Air-to-surface missiles • Man-portable • S/M/IRBMs • Artillery • ICBMs • SLBMs • Cruise missiles • Increased accuracy • MIRVs	• No declarations • Formal declarations • Cities as targets • Deterrence only (2nd strike emphasis) • Preemption • Tactical uses • Nuclear warfighting • Targets: - Leadership - Nuclear assets - Military forces - Industry • Extended deterrence • Flexible response • Signal resolve/ prestrategic • Limited nuclear options • Inevitable escalation control • Reduced warfighting emphasis	• Separate nuclear command • Civilian control of warheads • Military control of warheads • Forward deployments • Two man rule • Fail-safe procedures • PALs • Enhanced C3 • Enhanced security measures	• Deception • Mobilty • Dispersal on warning • Launch on warning • Hardened silos

Important thresholds stand out in the process of advanced nuclear proliferation. Without nuclear testing or outside assistance from an established nuclear weapons state, for instance, it is likely to be very difficult for a new nuclear power to develop multi-stage thermonuclear weapons or to have confidence in the performance of boosted weapons. Numbers of nuclear weapons may be limited by constraints on the availability nuclear weapons materials or by a political reluctance to move beyond a small, unacknowledged capability. Initial approaches to survivability may also be constrained: technical weaknesses may make it hard to achieve invulnerable fixed deployments and political concern about loss of control over nuclear weapons in unstable, third world countries may rule out mobility as a means of ensuring

survivability. For some developing countries, the technical requirements of effective safety, command, and control also may prove difficult to meet.

2.3 NUCLEAR WEAPON ACQUISITION STRATEGIES.

Recent experience demonstrates that countries seeking a basic nuclear-weapons capability are likely to pursue one or more of five basic approaches. As depicted by Figure 2-1, on the following page, problem countries can:

- Use dedicated facilities;
- Divert materials or facilities from legitimate civilian purposes;
- Purchase needed materials or inputs;
- Steal needed materials, inputs, or even weapons (particularly in the post-Soviet world); and
- Inherit either production capabilities or nuclear weapons.

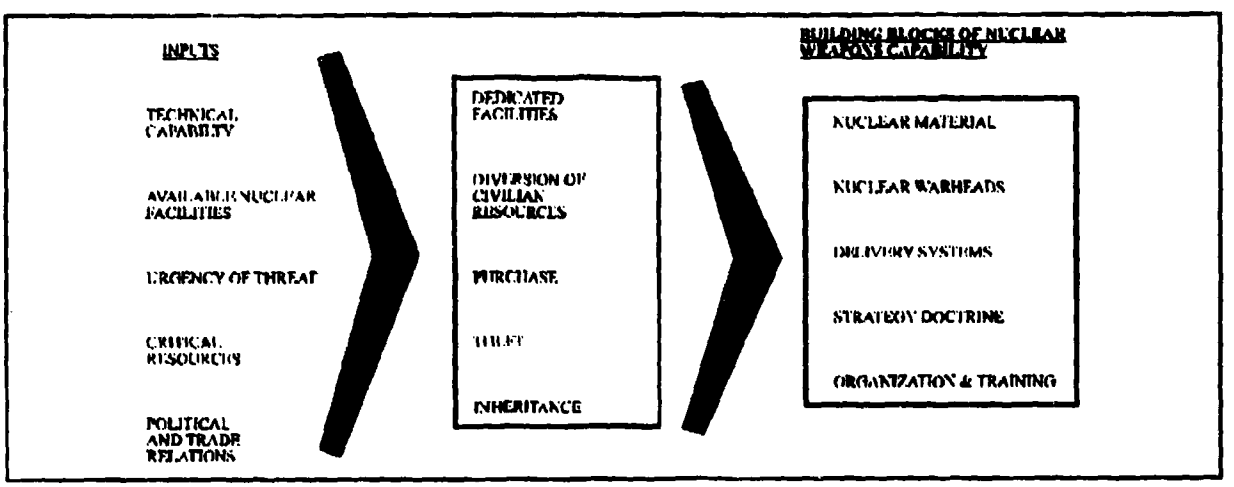

Figure 2-1. Acquisition approaches and inputs.

A country's level of indigenous technical capabilities and resources, the availability of nuclear (and other) facilities, the urgency of the threat, patterns of political and trade relations, and the impact of external export controls all will affect the relative emphasis placed on different approaches (for example Pakistan relied on dedicated production while Libya's Colonel Qaddaffi attempted to purchase a weapon). Moreover, elements of several different approaches are quite often mixed together (e.g., Iraq's dedicated "mini-Manhattan Project" to produce nuclear weapons also drew on extensive foreign purchases of needed inputs). Thus, these alternative approaches should not be viewed as mutually exclusive, but

as broad acquisition thrusts, particularly with reference to the acquisition of nuclear-weapons materials, the most difficult technical obstacle to a basic nuclear-weapon capability.

2.3.1 Dedicated Production.

Beginning with the United States, each of the first five acknowledged nuclear powers built special-purpose dedicated facilities for producing nuclear-weapons materials. Pakistan also has taken this approach. Following the destruction of the Iraqi Osirak research reactor supplied for peaceful purposes by France, Saddam Hussein also set out to build dedicated production facilities. Though the Dimona reactor was purchased from France in the 1950s as a research reactor, there was little doubt then, in either Paris or Tel Aviv, that its basic purpose was to provide plutonium for an Israeli nuclear weapons program.

Given a decision for dedicated production, the next question confronting proliferation problem countries is whether to build facilities for producing plutonium or for enriching uranium -- or to do both. Each has its own unique characteristics, technical complexity, advantages, drawbacks, and proliferation implications.

2.3.1.1 Plutonium Production. Dedicated production of plutonium -- which results when U-238, the most common isotope in natural uranium, absorbs neutrons -- requires a design for reactors, feed fuel, and a neutron moderator. The spent fuel must then be reprocessed to separate the plutonium product from residual uranium and waste products. Table 2-2 summarizes some factors to consider in assessing the ease or difficulty of dedicated plutonium production.

Table 2-2. Dedicated plutonium production.

	DESIGN PRINCIPLES	ENGINEERING	MATERIALS	SAFETY/ ENVIRONMENT	MAGNITUDE OF EFFORT
REACTOR	Well-known; No major technical obstacles	No significant obstacles	Need moderator (high quality graphite, D_2O)	Radiation hazard; Criticality danger	Small relative to some enrichment processes
REPROCESSING	Well-known	Some engineering obstacles	No significant obstacles	Radiation hazard (requires remote handling); Potential criticality	Small relative to some enrichment processes

As demonstrated by North Korea, successful, indigenous construction of a small plutonium production reactor is not too demanding technically for many proliferation problem countries. Basic reactor designs have been in the public domain for many years. Natural uranium is fairly readily available and also is not safeguarded by the IAEA, although members of the NPT are obligated to report its sale or purchase. Graphite-moderated reactors may be particularly attractive for proliferators because they use natural uranium and do not require heavy water.

Development of a reprocessing capability appears relatively more difficult, especially if larger-scale operations on the order of tens of tons of spent fuel throughput per year are desired. This has less to do with basic design principles -- which are well known -- than with engineering obstacles and requirements. By way of illustration, Argentina's efforts during the 1980s to complete a 200 ton per year reprocessing plant repeatedly stumbled over such engineering difficulties; North Korea's reprocessing plant was only half-completed when visited by IAEA officials in June, 1992, despite at least several years of efforts.

2.3.1.2 Highly Enriched Uranium Production Methods. For quite some time, dedicated production of weapons-grade enriched uranium -- uranium in which the percentage of U-235 has been enriched to over 90 percent in comparison with approximately 0.7 percent U-235 in natural uranium -- was viewed by many non-proliferation specialists as possibly too demanding for most third world problem countries. Both China's 1964 use of highly enriched uranium in its first nuclear weapon and Argentina's announcement two decades later that it had mastered gaseous diffusion enrichment technology came as surprises. By the 1990s, however, Pakistan, India, Argentina, Brazil, South Africa, Iraq, and Israel had successfully enriched uranium, though not in all cases to weapons grade and often with technical assistance or inputs purchased or stolen from more advanced countries.

In these endeavors, a wide range of enrichment processes have been pursued or considered by problem countries as well as by the first five acknowledged nuclear powers. As summarized by Table 2–3, these enrichment processes -- from gaseous diffusion to thermal diffusion -- can be compared according to their design, engineering, materials, and safety/environment requirements, as well as the required magnitude of effort and their efficiency in enriching uranium. With one possible exception, all these processes are capable of enriching uranium to a weapons-grade level, given enough time.[4]

Gaseous diffusion was the predominant technology used by the United States and by the other acknowledged nuclear powers to produce weapons-grade uranium. Relatively inefficient, it requires many enrichment stages. Some technical aspects are still classified, which could make it tougher for developing countries to master this approach. Moreover, the difficulties of concealing a gaseous diffusion enrichment program, due to its large facilities and use of large amounts of electricity, would be an important drawback.

The basic design principles of the gas centrifuge enrichment method also are well-known. While there are some engineering obstacles and requirements for special materials, there are no major technical secrets that could significantly hamper problem country efforts. The gas centrifuge method can be used on a small-to-medium scale; moreover, a large number, possibly as many as 1,000 centrifuges -- enough for about one bomb's worth of material per year -- probably can be hidden successfully from National Technical Means (NTM) of

[4]There is some dispute about the ability of the chemical exchange (CHEMEX) process to enrich to weapons grade.

Table 2-3. Dedicated uranium enrichment.

PROCESS	Design Principles	Engineering	Materials	Safety/ Environment	Magnitude of Effort	Efficiency
Gaseous Diffusion	Well-known; Complex; Trade secrets	Barrier is obstacle; Pumps required	Barrier material	Poisonous fluoride	Big facility; Cascade process; Lots of electricity;	Inefficient
Centrifuge	Well-known; No major technical obstacles	Engineering obstacles; Mechanical tolerances	Composites; Fancy steel; Low mechanical tolerances	Poisonous fluoride	Cascade process; 100s-1000s; Can be scaled down;	More efficient than gaseous diffusion
Jet Nozzle	Well-known; No major technical obstacles	Some engineering obstacles	No significant obstacles	Poisonous fluoride	Cascade process; Can be scaled down; Electricity	Inefficient
EMIS	Well-known; No major technical obstacles	Few obstacles	No significant obstacles		Labor-intensive; Big facility; Electricity intensive;	Inefficient (high separation but low quantity)
CHEMEX	Not well-known; No major technical obstacles	Some engineering obstacles (e.g., pipes)	Need access to chemicals	Criticality problem from use of liquids	$$	More efficient than gaseous diffusion
LIS	Well-known; Complex; Trade secrets	Engineering obstacles; Need steady laser source	No significant obstacles	If molecular process, poisonous fluoride	Economic on small scale; $ (in principle)	Most efficient (in principle)
Thermal Diffusion	Well-known; Simple	Not difficult	No significant obstacles	If use UF6, poisonous fluoride	$$$	Very inefficient

surveillance. Consequently, it is not surprising that several recent problem countries, including Pakistan, Iraq, and Brazil, have been attracted to this technology.

South Africa's use of the jet nozzle method to produce highly enriched uranium has so far been unique. This method is relatively inefficient, and suffers from high electricity requirements.

Until post-Gulf War discovery of Iraq's electromagnetic isotope separation (EMIS) program, this enrichment method was widely assumed to be too inefficient and virtually overlooked. Iraq's example and this technique's relative simplicity, however, could stimulate interest in EMIS in other third world countries. Chemex (chemical exchange) and laser isotope enrichment may be two other potential proliferation sleepers. Chemex has been largely

unproven in enriching uranium to a weapons-grade level, although it is considered to be more efficient than gaseous diffusion. Laser isotope separation (LIS) is, in principle, the most efficient method, but it has not advanced beyond experimental levels.

Countries seeking to put in place a dedicated uranium enrichment capability may choose to develop more than one method. Iraq was pursuing in varying degrees EMIS, centrifuge, gaseous diffusion, chemex, and LIS. Countries may also use a combination of methods. For the Hiroshima bomb, the United States used thermal diffusion as a first stage of enrichment, followed by a gaseous diffusion stage, topped off by EMIS.

2.3.2 Diversion.

Diversion from a civilian nuclear power or research program offers problem countries a second possible approach to acquire nuclear-weapons material. Beginning with creation of the IAEA safeguards system in 1957, however, undetected national diversion has become steadily more difficult, both politically and technically. But a new threat may be emerging: diversion of materials not from civilian programs but from purported nuclear-powered submarine programs. Moreover, diversion of dual-use materials, equipment, and components from legitimate civilian uses to a nuclear-weapons program has frequently contributed to the construction of dedicated production facilities and, to a lesser degree, to crossing the other hurdles to a basic nuclear capability.

2.3.2.1 Diversion from Safeguarded Nuclear Activities. Over the past decades, a variety of proliferation diversion paths have been publicly identified and steps taken to close them. In some instances, such steps were taken as a general precaution; in others, problem countries were probably making plans for diversion. The most important of these paths are:

- Diversion and reprocessing of spent fuel from a peaceful nuclear research reactor;
- Clandestine irradiation of natural uranium targets in a safeguarded research reactor;
- Diversion and reprocessing of spent fuel from a nuclear power reactor;
- Diversion of spent fuel at the front end of a reprocessing facility;
- Diversion of plutonium from the back end of a reprocessing facility;
- Diversion of LEU fuel and subsequent further clandestine enrichment;
- Diversion of HEU research reactor fuel; and
- Clandestine misuse of an enrichment facility to produce weapons-grade material.

In all these diversion paths, the IAEA safeguards system is a significant barrier. Its mix of technical monitoring and materials accounting, checked by on-site inspections, is an important obstacle to successful clandestine diversion. Detection could entail high political costs.

Nonetheless, questions may arise about safeguards' effectiveness at particular facilities or for particular civilian nuclear operations. Fear of successful Iraqi diversion appears to have been a critical consideration in Israel's 1981 decision to destroy Iraq's safeguarded research reactor. Also, the margin of error in safeguarding reprocessing plants also is unavoidably very high; on the order of 10 per cent of the throughput cannot be accounted for accurately. For that reason, the United States has since the 1970s repeatedly opposed efforts by Pakistan, South Korea, and other actual or potential problem countries to acquire even safeguarded reprocessing facilities. Safeguards coverage may also be too narrow or not yet in place. For example, until Ukraine, Kazakhstan, and other former Soviet republics join the NPT, they will have no legal obligation to accept IAEA safeguards on nuclear power and research facilities in their territories.

From the standpoint of a nuclear weapon designer, diverted plutonium from power reactors would be less desirable than plutonium from a dedicated production reactor because it is likely to contain more Pu-240, which might degrade the performance or reliability of a weapon. But it would not definitely preclude its use as nuclear-weapons material, as the United States publicly revealed in the late-1970s.

2.3.2.2 Nuclear-Powered Submarine Programs. Nuclear-weapons material might be enriched under the cover of research, development, and fuel production for a nuclear-powered submarine program. India, Argentina, and Brazil are contemplating such programs. For NPT parties, there is no obligation to place military uses of nuclear energy under safeguards.

2.3.2.3 Diversion of Dual-Use Inputs to Weapons Programs. Diversion of nuclear materials or facilities has so far not been a widespread acquisition strategy. However, diversion of dual-use materials, components, and equipment from legitimate civilian uses to support dedicated nuclear-weapons related activities has been important to many problem countries. For instance, many aspects of Iraq's pursuit of a nuclear materials production base rested on diversion of imported dual-use items from their stated end-uses. This is likely to remain so, particularly because the strengthening of export controls since the early 1970s has made it increasingly difficult for problem countries to obtain equipment and materials clearly destined for nuclear uses.

2.3.3 Purchase.

The purchase of nuclear-weapons-related feed materials, components, equipment, technology, and facilities has figured prominently in the dedicated nuclear-weapons programs of many of today's aspiring or new nuclear powers. Efforts have also reportedly been made to purchase nuclear weapons, though so far unsuccessfully. The breakup of the former Soviet Union

threatens to increase significantly the risk that nuclear weapons material or nuclear weapons might be sold clandestinely to aspiring new nuclear powers.

2.3.3.1 Shopping for Inputs. For many problem countries, attempted purchase of needed materials, equipment, and technology has been and is likely to remain an important part of their nuclear-weapons acquisition strategy. But very significant changes also have occurred in the availability of such items since France agreed to supply Israel with an unsafeguarded research reactor, fuel, and heavy water in 1957 -- no questions asked.

The major nuclear suppliers have taken a series of steps to restrict and regulate nuclear-related exports. These steps included:

- Agreement by the early 1960s not to export research reactors or power reactors without a commitment to use them only for peaceful purposes, and to put them under safeguards;

- Agreement in the 1968 NPT not to export nuclear-related equipment and materials without safeguards;

- Agreement in the 1978 Nuclear Suppliers' Guidelines to use restraint in the sale of reprocessing and enrichment facilities, equipment, or technology; and

- Restrictions on dual-use exports to countries of proliferation concern.

In effect, a virtual ban on sales by the major suppliers of materials, equipment, components, facilities, and technology that could help problem countries produce weapons came into being. As a result, almost all such purchases now take place clandestinely and illegally.

Purchase from so-called emerging nuclear suppliers -- countries such as Argentina, China, South Africa, India, and South Korea -- still remains a possible option. But here, too, there are signs that many of these suppliers are increasingly willing to abide by the norms of nuclear supply restraint.

The breakup of the former Soviet Union adds a new and important uncertainty. The newly independent republics collectively possess a diversified nuclear industry; their export controls and regulations are weak; and their incentives to sell are strong. Further, the dismantlement of upwards of 15,000-20,000 former Soviet nuclear warheads will all but certainly place great strains on security procedures to prevent sale of plutonium or highly enriched uranium to outside powers. As a result, problem countries could well seek out former Soviet state firms in future attempts to purchase nuclear-weapons materials or other program inputs.

2.3.3.2 Purchase of a Nuclear Weapon. Until now, no country has been able to purchase a nuclear warhead directly from another country, although Libya's Colonel Qaddaffi reportedly sought to do so from China in the 1970s, and in the late 1950s the Soviet Union apparently

reneged on an agreement to give a sample nuclear warhead to China. Events in the former Soviet Union again could radically change this situation. The possibility cannot be precluded that either an assembled nuclear weapon or one or more weapon pits might be sold in collusion with authorities.

2.3.4 Theft of Nuclear-Weapons Material or Weapons.

In the past, nuclear-weapons related know-how has occasionally been stolen to advance toward a nuclear capability. For example, the blueprints, technical documents, and list of the procurement network for the European Uranium Enrichment Consortium (URENCO) gas centrifuge facility in the Netherlands were stolen by A.Q. Khan, then an employee at URENCO, and later the head of Pakistan's nuclear weapons program. This method of technology acquisition is likely to figure in other countries' future nuclear acquisition strategies.

Thus far, however, aspiring new nuclear powers have apparently not sought to steal nuclear-weapons materials or nuclear weapons themselves. Tight security in the military realm (both in the United States and in other acknowledged nuclear powers) and still limited civilian commerce in nuclear-weapons usable plutonium may partly explain this situation. The risk of drastic military retaliation could be involved, as well. Moreover, most problem countries are likely to want to acquire more than a few bombs.

In the coming decade, opportunities may increase for stealing nuclear-weapons material -- whether plutonium or weapons-grade uranium from former Soviet nuclear weapons or civilian plutonium being shipped from Europe back to Japan for use in that country's nuclear power program. This could change the relative attractiveness of this acquisition path to a desperate or rogue government. Moreover, such theft probably would be the most likely means for terrorists to acquire nuclear-weapons material.

2.3.5 Inheritance of a Nuclear Capability.

The collapse of the Soviet Union is a first in the nuclear age: a nuclear superpower has ceased to exist, split into new and mutually suspicious states. Though the leaders of Ukraine, Kazakhstan, and Belarus have agreed to eliminate all nuclear weapons on their territories, that commitment will take nearly a decade to fulfill -- if it is fulfilled. Many of the newly independent republics also still have on their territory parts of the former Soviet Union nuclear weapons production complex. For one or more of these republics, nuclear inheritance may be a route to acquisition either of nuclear weapons or a substantial nuclear export capability.

Considerable uncertainty also characterizes the political succession in China. Should political instability lead to regional separatism or even civil war, command and control over the Chinese nuclear arsenal may not be assured. Nuclear inheritance could play a role here, too.[5]

2.4 TRENDS.

Over the past decades, as summarized by Table 2-4, on the next page, the current acknowledged, unacknowledged, and aspiring nuclear powers have taken a mix of approaches to acquire nuclear-weapons material, from dedicated production to efforts to purchase a nuclear warhead. Different patterns of advanced proliferation after acquisition of a first nuclear device have been evident. A number of key trends stand out and are likely to shape future acquisition strategies.

Table 2-4. Past primary acquisition approaches.

Material	Dedicated Production	Diversion	Purchase	Theft	Inheritance
Plutonium	• United States • Soviet Union • United Kingdom • France • China • Israel • North Korea (possibly underway)	• Taiwan (planned) • India	• Libya (attempted)		• Ukraine • Kazakhstan • Belarus
Highly Enriched Uranium	• United States • Soviet Union • United Kingdom • France • China • Pakistan • South Africa (aborted) • Iraq (aborted) • Brazil (aborted)			• Pakistan (enrichment plans)	

[5] Lee W. Gentry, The People's Republic of China, Proliferation Implications of Political Succession, Science Application International Corporation, January 20, 1992.

2.4.1 Choice of Approach: Dedicated Production.

With isolated exceptions, efforts to put in place a dedicated production infrastructure will probably characterize future efforts of most third world countries to acquire nuclear-weapons. In large part, this reflects the success of the IAEA safeguards system, backed up by the major suppliers, in reducing the feasibility and raising the political costs of diversion. No clear trend is evident, however, with regard to making plutonium or weapons-grade enriched uranium the material of choice, or between different enrichment methods.

2.4.2 Indigenous Production vs. Self-Sufficiency.

As in the past, most dedicated production programs can be expected to draw on purchases and possibly theft of feed materials, components, equipment, and technology from both major and newly emerging suppliers. Initially, completely indigenous production will be rare. Over time, a self-sufficient capability may develop, with new nuclear powers able to duplicate foreign inputs and to continue their programs without major purchases.

Continued tightening of global nuclear supply restrictions and procedures will all but certainly make it even harder for proliferation problem countries to purchase or steal needed inputs from the major suppliers. The emerging suppliers may offer possible alternatives. But these countries are likely to come under increasing pressures to adhere to global supply norms.

2.4.3 Nuclear-Weapons Cooperation.

Some aspiring new nuclear powers may cooperate among themselves, providing each other with nuclear weapons related know-how, technology, materials, and equipment. In many cases, cooperation would build on preexisting military, political, and economic ties between such countries. It could be motivated by mutual need, pursuit of economic gain, or political-military advantage. This would revive the pattern of the first decades of the nuclear age when cooperation among acknowledged nuclear powers was more often the norm than the exception.

2.4.4 The FSU Problem.

The breakup of the former Soviet Union is a major problem, which could affect significantly the future nuclear proliferation acquisition process. Until effective export control systems are put in place throughout the new nations, open or clandestine procurement of technology, equipment, materials, and components from hard-pressed firms within the former Soviet nuclear infrastructure must be feared. Diversion and sale of weapons-usable materials, if not of nuclear-weapons or their fabricated components, also cannot be ruled out. Inheritance by Ukraine, Belarus, or Kazakhstan is a real possibility.

2.4.5 Increased Availability of Civilian Plutonium.

Civilian use of plutonium is likely to increase in the coming decade, heightening the risk of diversion or theft. However, Japan, a major potential consumer, is reexamining the economics and political costs of extensive use of plutonium to fuel its nuclear power reactors.

2.4.6 Global Diffusion of Technology.

Nearly fifty years after the first detonation of a nuclear device, nuclear weapons are an old technology. Their basic principles are well known. Moreover, since 1945, there also has been an accelerating global diffusion of technology as well as progress by many countries up the ladder of industrialization. It is becoming increasingly less difficult for countries seeking nuclear weapons to overcome the obstacles to a basic nuclear capability, regardless of whether Soviet breakup results in unprecedented leakage of weapons-related technology, materials, or even weapons. For most proliferation problem countries, this central fact sets the parameters of their future nuclear proliferation acquisition strategy: technical barriers, reinforced by export controls and supplier restraint, can slow their advance; they cannot block it forever.

2.4.7 Residual Constraints on Advanced Proliferation.

Despite the declining impact of technical barriers to acquiring a basic nuclear-weapons capability, new nuclear powers still are likely to confront significant technical constraints on more advanced proliferation. Development of staged thermonuclear and boosted warheads; the fielding of longer-range, reliable ballistic missile systems; development of sophisticated control and safety technologies; advanced nuclear weapons safety techniques; and the deployment of survivable second-strike nuclear forces are some of the challenges that could prove troublesome for many new nuclear powers to meet.

SECTION 3

NUCLEAR NONPROLIFERATION EFFORTS

3.1 EARLY HISTORY.

Curbing the spread of nuclear weapons and related technologies has been an important foreign policy goal of the United States for nearly half a century. In November 1945, the United States, Great Britain, and Canada signed an "Agreed Declaration on Atomic Energy" that called for the creation of a multilateral body within the United Nations to design and implement safeguards against the use of atomic energy for destructive purposes. This tripartite proposal led to the establishment of a United Nations Atomic Energy Commission on January 24, 1946.

In an effort to further the goals of the commission, U.S. Secretary of State James Byrnes appointed a special committee in January 1946 to develop a comprehensive American proposal. The committee's report, known as the Acheson-Lilienthal Report, identified the production of fissionable materials, as opposed to weapons design, as the critical step in achieving a nuclear weapons capability. It concluded that a system of full controls over all nuclear material was necessary to establish peaceful, commercial nuclear industries without at the same time contributing to military programs. The report accordingly called for the establishment of an international authority to regulate the commercial development of nuclear energy, with the authority having full ownership and control over all items and activities which could be diverted to a weapons program.

The Acheson-Lilienthal Report formed the basis for the Baruch Plan, which was introduced at the first meeting of the U.N. Atomic Energy Commission in June 1946. This plan called for the establishment of an International Atomic Development Authority to regulate and control all aspects of the development and use of atomic energy. With the Soviet Union, which exploded its first nuclear device in 1949, and other countries anxious to enter the nuclear field, the United States was not successful in gaining acceptance of its far-reaching proposals.

President Eisenhower subsequently laid the cornerstone of the current nuclear nonproliferation regime in his "Atoms for Peace" address to the United Nations General Assembly in December 1953. Eisenhower's plan envisaged the creation of an International Atomic Energy Agency (IAEA) under the aegis of the United Nations to which the supplier nations would contribute fissionable material to serve the peaceful needs of mankind. The proposed agency would be responsible for developing and implementing a system of controls, including international inspections, over the distribution of these materials to civilian nuclear projects. The Eisenhower initiative paved the way for the establishment of the IAEA in 1957, although the new agency bore only a limited resemblance to the kind of institution envisaged in the Atoms for Peace address.

Since then, U.S. policies to combat the spread of nuclear weapons have evolved to meet new and different challenges, including China's entry into the "nuclear club" in 1964, India's detonation of a nuclear device in 1974, and the spread of sensitive nuclear equipment and technologies to such areas as the Middle East, South Asia and the Korean Peninsula. U.S. approaches to the problem have involved a combination of unilateral initiatives and controls, bilateral arms control agreements, treaties, and other commitments, including informal supplier guidelines undertaken in a variety of multilateral fora.

3.2 U.S. NONPROLIFERATION POLICY.

3.2.1 Recent Executive Branch Initiatives and Directives.

3.2.1.1 July 1992 Nonproliferation Initiative. On July 13, 1992, the United States announced a "Nonproliferation Initiative" to bolster American efforts to stem the spread of weapons of mass destruction, including nuclear, chemical, and biological weapons. The initiative seeks to integrate new and existing policies "in an overall framework to guide U.S. nonproliferation policy in the years ahead." Key nuclear nonproliferation policy objectives embodied in the initiative include a broad range of multilateral and regional initiatives such as:

Multilateral Actions:

- Compliance with international nonproliferation norms. The United States will take into account other countries' performance on key international nonproliferation norms in developing its cooperation and technology transfer relationships, and will consult with friends and allies on similar approaches.

- Enforcement of international nonproliferation norms. The United States will consult with friends and allies on international actions to be taken against serious violations of nonproliferation norms, e.g., the transfer of any weapon of mass destruction or key weapon facility, violation of safeguards agreements, or confirmed use of nuclear weapons.

- Support for special inspections and weapon destruction. The United States will examine, in consultation with friends and allies, establishment of multilateral funding efforts to support special inspection regimes where necessary and to help states destroy existing weapon stockpiles.

- Harmonization of export controls. The United States will promote harmonized nonproliferation export control lists and enforcement, including an agreement among suppliers not to undercut one another's export restraint decisions.

Regional Efforts:

- Targeted Approaches. The United States will continue to focus special efforts on the dangers of proliferation in South Asia, the Persian Gulf, the Middle East, and the Korean Peninsula.

- Former Soviet Union. The United States will continue to work with authorities from Russia and the other new states toward the following objectives: 1) implementation of all relevant international agreements, such as the Treaty on the Non-Proliferation of nuclear weapons (NPT); (2) effective internal accounting and physical protection against theft or diversion of nuclear-related materials and equipment; (3) effective export controls on nuclear (as well as chemical, biological, and missile) technologies consistent with existing multilateral regimes; (4) safe and secure dismantlement of nuclear warheads and effective controls over nuclear-weapon material and; (5) creation of opportunities for weapons scientists and engineers to redirect their talents to peaceful endeavors.

Global Norms:

- NPT and Tlatelolco. The United States will seek the indefinite extension of the NPT in 1995 and full entry into force of the Treaty of Tlatelolco by 1993.

- International Atomic Energy Agency (IAEA). The United States will work with other nations to strengthen the IAEA and will support needed increases in the safeguards budget.

Intelligence:

- Nonproliferation Center. The U.S. Intelligence Community, including the interagency Nonproliferation Center created in September 1991, will increase support to international nonproliferation regimes and seek to enlarge the pool of experienced, well-trained experts committed to the nonproliferation mission.

Nuclear Materials:

- Nuclear Materials Production. The United States will indefinitely cease production of plutonium and highly-enriched uranium for nuclear explosive purposes. This step is intended to encourage countries in regions of tension such as the Middle East and South Asia to take similar actions, such as those proposed in the May 1991 Middle East Arms Control Initiative.

3.2.1.2 May 1991 Middle East Arms Control Initiative. The Middle East Arms Control Initiative, announced on May 29, 1991, calls on the five major suppliers of conventional arms (United States, France, Great Britain, China, and the Russian Federation) to meet and

discuss the establishment of guidelines for restraints on destabilizing transfers to the region of conventional arms, as well as weapons of mass destruction and associated technology, including advance notification of "certain arms sales."

All countries in the region are called on to implement a verifiable ban on the production and acquisition of weapons-usable nuclear material (enriched uranium or separated plutonium) and place their nuclear facilities under IAEA safeguards. The initiative supports the eventual creation of a regional nuclear weapon-free zone and calls on all countries that have not done so to accede to the NPT.

3.2.1.3 International Science and Technology Centers. The United States has been the prime mover behind efforts to create an International Science and Technology Center (ISTC) in Moscow, and another, smaller center in Kiev, to deal with the nuclear "brain drain" problem created by the breakup of the Soviet Union. The centers will provide scientists and engineers in the former Soviet Union with "opportunities to redirect their talents to non-military endeavors and minimize any incentives to engage in activities that could result in the proliferation of weapons mass destruction and other advanced military technologies."

3.2.2 Role of U.S. Departments and Agencies.

The executive departments and agencies that are involved in the development and implementation of U.S. nuclear nonproliferation policy include: the Departments of Commerce, Defense, Energy, State, and Treasury, the Nuclear Regulatory Commission (NRC); the Arms Control and Disarmament Agency (ACDA); the National Security Council; the Joint Staff; and the Intelligence Community (IC). The Department of Commerce, the Department of Energy, and the NRC are responsible for licensing nuclear-related exports. A discussion of the roles and administrative organizations of these government bodies is found in the Appendix A, "USG Agency Roles in Nuclear Nonproliferation Policy."

3.2.3 Statutory Basis of U.S. Nonproliferation Policy.

The main pieces of legislation concerning U.S. nuclear nonproliferation policy are summarized below.

3.2.3.1 Atomic Energy Act of 1954, As Amended (AEA). The Atomic Energy Act of 1954 established statutory authority for the commercial and military development of nuclear energy and created the Atomic Energy Commission, which was given primary responsibility for overseeing the government's nuclear programs. The Energy Reorganization Act of 1974 abolished the Atomic Energy Commission and divided its responsibilities between the Nuclear Regulatory Commission, which oversees and regulates civilian and commercial aspects of atomic energy, and the Department of Energy, which runs the nuclear research laboratories and the nuclear weapons production complex. The Act provides legal authority for the Department of Energy, The Nuclear Regulatory Commission, and The Department of Commerce to control exports of nuclear technology and equipment.

3.2.3.2 Nuclear Non-Proliferation Act of 1978 (NNPA). The NNPA was enacted in part to strengthen implementation of the Nuclear Non-Proliferation Treaty (NPT) and to further institutionalize the IAEA safeguards and inspection system as an integral part of international nuclear commerce (Section 201). Priority for receiving U.S. energy resource development assistance is accorded nations which have signed the NPT. Section 309(c) of the NNPA directs the President to establish procedures to control exports of dual-use items licensed by the Department of Commerce and commodities "of significance for nuclear explosive purposes." Section 309(c) further provides for review by the Department of State, the Arms Control and Disarmament Agency, the Department of Energy, and the Department of Defense before the Department of Commerce can issue export licenses.

3.2.3.3 Foreign Assistance Act of 1961, As Amended (FAA of 1961). In 1976-77, Senators Symington and Glenn sponsored amendments to the Foreign Assistance Act of 1961 that require the President to suspend economic and military assistance to countries that acquire or supply the wherewithal to produce weapons-grade uranium and plutonium, unless their nuclear facilities and materials are placed under IAEA safeguards. President Carter invoked Glenn-Symington when he cut off aid to Pakistan in 1979.

In 1981, the Congress, responding to the Soviet invasion of Afghanistan, authorized a waiver of prohibitions on aid to Pakistan, if the President determined that to do so was in the national interest. In 1985, Congress passed the Pressler amendment (Section 620E(e)), which conditioned aid to Pakistan on a written Presidential determination to Congress each year that "Pakistan does not possess a nuclear explosive device and that the proposed U.S. assistance program will reduce significantly the risk that Pakistan will possess a nuclear explosive device." President Bush made this certification in 1989, but U.S. aid to Pakistan has been suspended since the beginning of FY 1991 (October 1, 1990) due to the inability of the President to make the necessary certification to Congress. Another amendment to the FAA of 1961, the Solarz amendment, authorizes the suspension of U.S. economic and military assistance to any country that illegally exports, or attempts to illegally export, nuclear materials and technology that would contribute significantly to the ability of a country to build a nuclear bomb.

3.2.3.4 Export Administration Act of 1979 (EAA). The Export Administration Act provides the Department of Commerce with authority to license nuclear-related dual-use items. The language of the Act, which provides legal authority for controlling exports of all dual-use commodities, technology and technical data, is very broad. Section 5 of the Act allows the President to prohibit or curtail the export of "any goods or technology subject to the jurisdiction of the United States...which would make a significant contribution to the military potential of any other country or combination of countries which would prove detrimental to the national security of the United States." Section 6 allows the President to limit the export of any goods or technology "to the extent necessary to further significantly the foreign policy of the United States or to fulfill its declared international obligations."

The EAA expired on September 30, 1990. However, under the International Emergency Economic Powers Act, President Bush has indefinitely extended the authority of the President to control exports of nuclear-related and other dual-use items.

3.3 MULTILATERAL AGREEMENTS AND INSTITUTIONS.

3.3.1 Treaties.

3.3.1.1 Treaty on the Non-Proliferation of Nuclear Weapons (NPT). This treaty, which entered into force on March 5, 1970, is the centerpiece of the global nuclear nonproliferation regime. 160 nations have joined the NPT. The goals of the Treaty are to prevent the further spread of nuclear weapons; promote the peaceful uses of nuclear technology; encourage a halt to the nuclear arms race; and achieve nuclear and general disarmament. The Treaty embodies the following key provisions:

Article I - Nuclear weapon states pledge not to assist non-nuclear weapon states in acquiring nuclear weapons.

Article II - Non-nuclear weapon states party to the Treaty pledge not to acquire or manufacture nuclear weapons.

Article III- Requires nuclear suppliers to place nuclear exports under IAEA safeguards and non-nuclear-weapon states to conclude safeguards agreements with the IAEA.

Article IV - Encourages international cooperation for "the further development of the applications of nuclear energy for peaceful purposes,...with due consideration for the needs of the developing areas of the world."

Article VI - Requires the parties to the Treaty to pursue negotiations in good faith on effective measures to end the nuclear arms race and achieve nuclear disarmament.

The United States has directed its efforts in recent years toward expanding membership in the NPT and supports the indefinite extension of the NPT at the 1995 Extension Conference. The way appeared to be opened for substantial strengthening of the NPT regime in May 1992, when the United States gained commitments from Ukraine, Belarus, and Kazakhstan to join the NPT as non-nuclear weapon states. As of publication, Ukraine and Kazakhstan have not yet carried out these commitments. Other favorable developments include South Africa's adherence to the Treaty in July 1991, China's in March 1992, France's in August 1992, and Niger's in September 1992.

3.3.1.2 Treaty of Tlatelolco. The Treaty for the Prohibition of Nuclear Weapons in Latin America, more commonly known as the Treaty of Tlatelolco, creates a nuclear weapons-free zone in that region. Adherents agree not to manufacture, test, or acquire nuclear weapons or to accept weapons on their territory deployed by others. To verify these pledges, the parties to the Treaty agree to accept IAEA full-scope safeguards on their nuclear facilities.

Under its entry-into-force provisions, the Treaty becomes effective once it and its protocols have been ratified by all eligible countries. However, 22 nations that have ratified the Treaty have waived this provision so that the Treaty has become effective for them. Only four countries (Argentina, Brazil, Chile, and Cuba) have yet to make the Treaty operative. Brazil and Chile have ratified the Treaty, but have not waived the entry-into-force requirement. Argentina has signed but is only now in the process of ratifying. Cuba has neither signed nor ratified the accord, but has indicated that it will join the Treaty after all other countries in the region have done so. On August 26, 1992, the Organization for the Prohibition of Nuclear Weapons in Latin America (OPANAL), which functions as a secretariat for the Treaty, adopted several amendments, presented jointly by Argentina, Brazil and Chile, which eliminate OPANAL's ability to conduct special inspections, authorizing only the IAEA to conduct such inspections. Argentina, Brazil and Chile must ratify the Treaty as amended and waive the entry-into-force requirement before it becomes effective for them. On August 24, France deposited its instrument of ratification of the Treaty's Protocol I, committing it to apply the Treaty's denuclearization requirements to its territorial possessions within the agreement's zone of application, i.e., Guadeloupe, Martinique, and the French Guyana. With the French move, all states with territories in the region, the United States, the United Kingdom, France, and the Netherlands, have signed and ratified Protocol I.

3.3.2 U.N.-Affiliated Organizations.

3.3.2.1 International Atomic Energy Agency (IAEA). The International Atomic Energy Agency is a U.N.-affiliated body which facilitates the transfer of peaceful nuclear technology to developing nations and verifies compliance with certain obligations under the NPT. Although the IAEA had in place a safeguards system prior to the creation of the NPT, the NPT greatly expanded the Agency's safeguarding activities. The United States remains committed to strengthening the IAEA safeguards system and has been active in encouraging other countries to place their nuclear facilities and materials under IAEA safeguards. The United States also contributes to the IAEA's technical assistance and cooperation programs.

3.3.2.2 United Nations Special Commission on Iraq (UNSCOM). United Nations Security Council Resolution 687 requires Iraq to accept the destruction, removal, or rendering harmless, under international supervision, of all ballistic missile systems with a range in excess of 150 kilometers, as well as chemical, biological and nuclear weapons-related materials, equipment and facilities. The United Nations created a Special Commission to carry out the provisions of this resolution. The nuclear aspects of the resolution are being implemented by the Special Commission with the assistance of the IAEA.

3.3.3 Informal Supplier Groups.

A number of informal supplier groups have been established to control exports of nuclear items and technology. The guidelines endorsed by the member states represent parallel political commitments and are not legally binding.

3.3.3.1 Zangger Committee. In the early 1970's, a group of nuclear supplier nations, chaired by the Swiss expert, Claude Zangger, entered into consultations to create a uniform set of standards to enforce the obligations of Article III, paragraph 2, of the NPT requiring safeguards on nuclear exports. In August 1974, the Zangger Committee (then including Australia, Denmark, Canada, Finland, West Germany, the Netherlands, Norway, the Soviet Union, the United Kingdom, and the United States) compiled a "trigger list" of nuclear materials and equipment which would be exported only under IAEA safeguards. Membership in the committee (also known as the Nuclear Exporters Committee) has expanded to include Austria, Belgium, Czechoslovakia, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, Poland, Russia, Sweden, and Switzerland. Controls on centrifuge uranium enrichment, nuclear fuel reprocessing, and gaseous diffusion enrichment technology were upgraded in the late 1980's. Control lists for heavy water production technology, were recently upgraded.

3.3.3.2 Nuclear Suppliers Group (NSG). In November 1974, another set of supplier consultations began, principally at the initiative of the United States. These talks were convened largely in response to three important developments: (1) the Indian nuclear test of May 1974; (2) French and West German decisions to supply enrichment and reprocessing facilities to developing countries; and (3) concern that the higher oil prices established by the Organization of Petroleum Exporting Countries would prompt Third World and other non-nuclear states to initiate or accelerate their nuclear power programs.

These discussions, conducted in London, included Canada, France, the Federal Republic of Germany, Japan, the Soviet Union, the United Kingdom, and the United States. Securing French participation was a major accomplishment, since France (which had refused to join the NPT and the Zangger Committee) could have undermined nuclear supply reforms.

Two major issues emerged in the round of talks that led to a new agreement in 1975. The first was whether equipment and technology for enrichment and reprocessing, the most sensitive parts of the nuclear fuel cycle from a weapons proliferation standpoint, should be transferred to non-nuclear states. The other issue was whether the adoption of full-scope (covering all nuclear facilities) safeguards by the recipient country should be made a condition of supply. Due to objections by France and West Germany, the Nuclear Suppliers Group did not adopt either of these proposals at that time.

In late 1975, the group adopted a trigger list, similar to that of the Zangger Committee, of items which would be exported only if subject to IAEA safeguards in the recipient state. In January 1976, members of the group exchanged letters endorsing a uniform set of guidelines

for the transfer of nuclear materials, equipment, and technology. These guidelines went beyond the Zangger Committee's requirements by imposing safeguards, not only on the export of nuclear materials and equipment, but on nuclear technology as well.

On April 3, 1992, the 27 member states of the NSG--which now includes most of the world's major suppliers of nuclear items--announced their agreement to a common set of guidelines governing the export of nuclear-related dual-use items. The guidelines, accompanied by an annex listing 67 categories of controlled equipment, material and technology, prohibit transfers of the items identified in the annex "for use in a non-nuclear weapon state in a nuclear explosive activity or an unsafeguarded nuclear fuel cycle activity or--in general, when there is an unacceptable risk of diversion to such an activity, or when transfers are contrary to the objective of averting the proliferation of nuclear weapons."

The guidelines further require the suppliers to obtain assurances on the intended use and end-use locations of the proposed transfers, as well as assurances that neither the items nor any replicas of them will be used in a nuclear weapons program or unsafeguarded nuclear fuel cycle activity. In an important, separate statement, the member states made IAEA full-scope safeguards a condition of supply.

3.3.3.3 Meeting of the Five on Arms Transfers and Nonproliferation. At a May 1992 meeting in Washington, the United States and the world's other four major arms-supplying nations (France, Great Britain, the Russian Federation, and China--all permanent members of the U.N. Security Council) agreed to "observe and consult upon" a set of "Interim Guidelines Related to Weapons of Mass Destruction." Under the guidelines, the five states agree not to export "equipment, material, services or technology which could be used" to develop or manufacture nuclear, chemical and biological weapons. The guidelines further require the five to "exercise restraint in the transfer of sensitive nuclear facilities, technology and weapons-usable material having in mind existing international practice" and to "promptly notify the International Atomic Energy Agency of the export to a non-nuclear weapons state of any nuclear materials, equipment, or facilities and place them under IAEA safeguards." More recently, China indicated an intent to withdraw from these discussions to protest U.S. aircraft sales to Taiwan and Saudi Arabia.

SECTION 4

IMPLICATIONS AND RESPONSES
POSSIBLE ROLES OF THE DEPARTMENT OF DEFENSE

4.1 INTRODUCTION.

Acquisition of nuclear weapons and effective delivery systems by third world countries will pose new threats to U.S. friends and allies, and eventually to the American homeland. At the operational level, possession of nuclear weapons by a third world adversary is likely to complicate significantly U.S. military missions and operations in regional contingencies. U.S. force requirements, deployments, doctrine, and operations all could be affected. Moreover, key friends and allies of the United States may have serious second thoughts about hosting U.S. forces, if there is a credible threat of nuclear attack against them. Prior to that stage, the United States is all but certain to be called on by some allies and friends to provide a deterrent umbrella against such a threat. Here, too, changes of U.S. forces and posture may be needed for credible deterrence or for a prompt damage limiting capability should deterrence break down.

The DoD already is an active participant in U.S. Government efforts to check nuclear proliferation. For instance, Department officers are actively involved with the Departments of State and Commerce in the export control process. The Department also helps to verify compliance with existing arms control agreements, while identifying future verification requirements and systems to meet those needs.

Overall, there is a growing recognition that dealing with new proliferation-related threats to U.S. security will increasingly be a major task for U.S. defense planners in the post-Cold War world. U.S. nonproliferation policy already faces a number of challenges, and new ones are almost certain to arise over the next few years. In some cases, existing or emerging challenges call for primarily political or diplomatic initiatives or responses. In many cases, however, the Department of Defense can play an important role. Possible DoD contributions fall within each of the major aspects of nuclear nonproliferation policy: checking proliferation, capping or rolling it back, and responding to proliferation and its consequences.

4.2 CHECKING NUCLEAR WEAPONS DEVELOPMENT PROGRAMS.

Table 4-1, on the following page, identifies challenges to efforts to check nuclear weapons development programs, initiatives responding to various challenges, and possible DoD roles in carrying out those initiatives. Possible DoD roles are discussed briefly below.

Table 4-1. Checking nuclear proliferation.

CHALLENGES	INITIATIVES	POSSIBLE DOD ROLES
• Increase priority of proliferation intelligence	• Enhance and refocus assets • Define requirements • Expand information sharing	• Allocate assets • Establish priorities • Expand training • Coordinate with allies
• Export control weakness	• Enhance exports tracking and controls implementation • Proliferation database • Enhance information sharing • Sanctions	• Policy and technical support • Support database building • Greater role in information sharing • Plan for sanctions and dealing with counter-sanctions
• Status of nuclear controls in FSU	• Technical aid in safe, secure dismantlement • Financial aid • Support for export controls	• Support safe, secure dismantlement • Support for nuclear emergency responses • Special operations contingency
• Inadequate disincentives	• Make proliferators pay a price • Increase UN capabilities • Sanctions	• Identify aid and cooperation levers • Support UN actions
• Increasing political-military incentives to refrain from proliferation	• Reaffirm guarantees • Rewards for good behavior	• Maintain forward presence • Provide nuclear umbrella • Tailored military assistance • Intelligence sharing
• Protection and defenses	• ATBM cooperation • UNSC action	• R&D and deployment of ATMB • Early warning
• Regional arms racing	• Regional test ban • Regional nuclear materials cut-offs • Other CBMs	• Support for regional stability • Technical assistance and logistical support for CBMs • Monitoring compliance
• Active measures to interdict, block, prevent proliferation	• Track and assess programs vulnerabilities • Training for special operations • Coalition building	• Special operations capability • Military contingency planning

4.2.1 Proliferation Intelligence.

As nuclear weapons proliferation grows in importance as a policy problem for the United States, the need for proliferation intelligence also increases. Like other departments and agencies with major intelligence responsibilities, DoD must consider adjusting its priorities to give greater emphasis to collecting and analyzing information on both nuclear proliferation threats and the views of proliferators on the roles of nuclear weapons. Intelligence assets, both human and technical, may have to be retasked to conform to changed priorities, and expanded training of personnel in proliferation-related subjects may be required. Consideration should also be given to placing a higher priority on proliferation intelligence in coordinating collection efforts with allies.

4.2.2 Export Controls.

Export controls on both nuclear items and nuclear-related dual-use items play a major role in U.S. and international efforts to inhibit nuclear weapon development programs. While such controls cannot prevent proliferation indefinitely, they can buy time for other measures to dampen proliferation incentives. DoD can continue and could possibly increase its policy and technical support for export controls. In particular, DoD could usefully expand the sharing of information with allies and in assisting on-going efforts to develop more comprehensive, computerized proliferation data bases that would help to track proliferation activities and provide early warning. DoD could also help plan both sanctions to be imposed against particular violators of export controls and responses to efforts to circumvent sanctions. Sanctions can be an effective means to raise the costs of proliferation.

Military-to-military contacts also need to be explored as a possible means to strengthen other countries' support for export controls. Such contacts could be especially useful in the case of China, since the Chinese military are a key players in export decisions. Military to military contacts with countries of Eastern and Western Europe as well as the former Soviet Union could also help to create or reinforce support for export controls.

4.2.3 Weapons Dismantlement Control in the FSU.

The break-up of the Soviet Union has created new and unanticipated challenges to the nuclear nonproliferation regime. Continued DoD support will be needed in efforts to ensure the safe and secure transport, storage, and dismantlement of former Soviet nuclear weapons. DoD support would also be essential in responding to nuclear emergencies, such as loss of control over nuclear weapons by successors to the Soviet Union. DoD could appropriately prepare special contingency plans to help deal with nuclear emergencies, such as the seizure of one or more nuclear weapons by dissident or terrorist groups.

Military-to-military contacts also may have a role here. Contacts with the Ukrainian military for instance, could help create a sense of U.S. support for Ukraine's security, reinforcing other arguments for honoring commitments to eliminate nuclear weapons and join the NPT.

[6]4.2.4 Proliferation Disincentives

Increasing disincentives to acquire nuclear weapons clearly is desirable. The basic principle should be to make proliferators expect to pay a price. The United States should try to reduce perceptions of the utility of nuclear weapons and increase awareness of both their political and economic costs. Both economic sanctions and the fear of such sanctions, including reductions in both bilateral and multilateral aid, should be brought to bear. In some cases, obtaining the authorization of the U.N. Security Council for economic sanctions would be desirable.

DoD could support U.S. policies in this area by identifying possible aid and cooperation levers. Cutting back military assistance (including training programs) and military-to-military contacts could help create pressure on proliferators to give up weapons-related nuclear programs. Particular emphasis might be placed on identifying the most critical military technologies that problem countries were seeking and assembling a supplier coalition to block access to such technologies. In extreme cases, DoD must be prepared to enforce economic sanctions by military means.

4.2.5 Political-Military Incentives to Refrain from Proliferation.

The priority of nonproliferation in U.S. relations with potential proliferators should be increased. Actions to slow weapons-related nuclear programs should be rewarded in some cases with increases in economic aid flexibility in authorizing the export of advanced technology. As appropriate, an increase in political and economic ties with other nations should be facilitated.

DoD also has a key role to play in supporting U.S. efforts to lessen incentives that can drive additional states to seek nuclear weapons. U.S. security guarantees can be a vital nonproliferation measure and maintaining a forward military presence in key areas can add to the credibility of such guarantee. With redeployments of U.S. nuclear weapons, how to continue providing a nuclear umbrella to countries threatened by nuclear-armed adversaries may need to be addressed. Cooperation with selected countries in anti-ballistic missile defenses should also be constant.

4.2.6 Protection and Defense.

Providing defenses against future nuclear-armed missile threats could reduce proliferation incentives in neighboring countries.[6] On-going DoD programs to develop more effective anti-tactical ballistic missiles (ATBMs) are key here. Contingency plans are needed for deploying such missiles in selected areas, as well as assessment of the costs and benefits of cooperative

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[6]For a fuller discussion of defenses against missiles, see Part Five of this paper.

ATBM programs with selected allies. DoD assets could also provide early warning of missile attacks on threatened allies.

4.2.7 Regional Arms Control.

Interest is growing in possible arms control and confidence- building initiatives to slow down rival nuclear weapons programs. The United States should help to solve regional disputes that may provide incentives for acquiring nuclear weapons. Particularly in the post-Cold War world, the feasibility of regional test bans, regional cutoffs in the production of nuclear materials, and other more limited confidence building measures (CBMs) should also be assessed. DoD could be called on to help monitor compliance with and provide technical assistance and logistical support for regional arms control measures.

4.2.8 Active Measures Against Proliferators.

Detailed assessments of possible active measures to interdict, block, or otherwise prevent instances of nuclear proliferation that would be especially damaging to U.S. interests would be desirable. Such measures could include cooperation in the recovery of nuclear weapons materials or even a nuclear weapon stolen from the former Soviet Union As appropriate, military contingency plans, including possible use of DoD's special operations capabilities, might be developed for active counter-proliferation missions.

4.3 CAPPING OR ROLLING BACK NUCLEAR PROLIFERATION.

In some cases, it may not be possible to halt nuclear weapons programs before they are well-advanced. It may still be possible, however, to induce countries to cap or even rollback such programs. In general, a policy of encouraging the capping or rolling back of nuclear proliferation faces many of the same challenges as a policy of checking such proliferation. Similarly, initiatives that would help to check proliferation could, with some enhancement or modification, facilitate capping or rollback.

Table 4–2, on the following page, identifies the more important challenges to capping or rolling back nuclear proliferation, initiatives to cope with such challenges, and possible DoD roles in those initiatives. Possible DoD roles that have not already been discussed are discussed briefly below.

4.3.1 Heading-off Nuclear Inheritance.

DoD is already actively involved in U.S. efforts to induce Ukraine, Kazakhstan, and Belarus to honor their commitments to become nuclear-free, e.g., by providing technical support for the safe and secure dismantlement of former Soviet nuclear weapons. These efforts need to continue. In addition, DoD capabilities could conceivably be called on to

Table 4-2. Capping or rolling back nuclear proliferation.

CHALLENGES	INITIATIVES	POSSIBLE DOD ROLES
• Export control weakness	• Enhanced exports tracking and controls • Information-sharing implementation	• Technical and policy support
• "Brain Drain" and possible nuclear inheritance (FSU)	• Expanded science centers • Stregthened regional security structures • Intensified diplomacy with republics • Accelerate nuclear withdrawals/dismantlement	• Technical support for science centers and for secure dismantlement • Help track people and materials
• Alternative security assurances	• New region-wide security guarantees • Regional political initiatives	• Support regional and stability security initiatives • Forward basing and combined exercises
• Alternative protection against attack (including clandestine)	• Regional defense cooperation • Planning for overseas nuclear searches	• ATBM cooperation • Defense assessments and plans • Support nuclear searches
• Regional arms control	• Regional test ban • CBMs • Regional nuclear materials cutoff	• Verification technology R&D • Monitoring and data sharing support

assist in emergency searches for diverted former Soviet nuclear weapons. Contingency planning is, therefore, warranted in this area.

4.3.2 New Security Assurances.

Steps to enhance the security of the new states of the Former Soviet Union also could contribute to rolling back their nuclear capabilities. A formal reaffirmation of earlier U.S. pledges to come to the aid of countries threatened with nuclear attack or blackmail consistent with the UN Charter, could be considered. DoD could add to the credibility of such a measure and otherwise demonstrate U.S. concern by military-to-military contacts, and officer exchanges and training.

4.3.3 Verification Technology for Regional Arms Control.

Regional arms control and confidence-building measures could well be part of capping or rolling back nuclear weapons programs. Possibilities include regional nuclear test bans and nuclear materials cutoffs, as well as confidence-building measures to limit force levels in designated border zones. DoD could support such measures by providing verification technologies. The costs and benefits of providing the products from NTM to back up regional nonproliferation agreements might be assessed.

4.4 RESPONDING TO NUCLEAR PROLIFERATION.

Nuclear proliferation will pose new security threats not only to the neighbors of proliferators but also to forward-based U.S. forces and in some cases U.S. allies and friends. DoD's military assets and expertise will be essential in responding to nuclear proliferation and dealing with the threats it poses (see Table 4-3 on the following page). Military planners could appropriately focus on:

- Regional nuclear threat assessments;
- Responses to loss of control over nuclear weapons;
- Design and maintenance of credible regional deterrence postures;
- Methods for disarming hostile new proliferators;
- Defenses for allies, U.S. forces, and eventually CONUS; and
- Provision of aid after the use of nuclear weapons.

4.4.1 Regional Nuclear Threat Assessments.

DoD's intelligence collection resources, technical expertise in weapons deployment, and analytical capabilities will increasingly need to include assessments of the potential threat posed by hostile third world nuclear powers against U.S. forces and allies. Existing models, or new modeling techniques could help assess the magnitude, geographic scope, and impact on U.S. and friendly forces, equipment, and operations of nuclear weapons use by a third world country over a range of possible scenarios. Ongoing support by DoD and its technical agencies to the regional CINCs could help them to understand how conflicts might arise, whether nuclear weapons might be used by a third world country, and, if so, with what objectives and on what targets.

Table 4-3. Responses to nuclear proliferation.

CHALLENGES	INITIATIVES	POSSIBLE DOD ROLES
• Regional nuclear threat assessments	• Problem country force estimates • Problem country doctrine and strategy • Analysis of US vulnerabilities	• Generate and rank collection requirements • Collect, process, analyze, and disseminate intellilgence data • Support to the CINCs
• Loss of nuclear weapon control	• Provide basic security information • Tech transfer for safety and security	• Use controls experience • Know-how about physical security and personnel reliability • Technical exchanges
• Design credible deterrence posture	• Make explicit defense planning a requirement • Articulate declaratory policies • Reafffirm security ties to threatened allies	• Identify response options and force packages • Planning for nuclear redeployment • Target assessment
• Disarming hostile new proliferators	• Analyze counterproliferation options	• Provide intelligence, targeting, and vulnerability analyses • Logistic support • Advanced munitions R&D
• Protection and defense for allies, US forces, and CONUS	• Planning for overseas clandestine threats • Pursue theater defenses	• Logistic support for overseas nuclear searches • ATBM R&D • Special operations
• Post-use aid	• Requirements and planning (overseas and CONUS) • Provide emergency assistance	• Initiate emergency response planning

4.4.2 Loss of Nuclear Weapon Control.

Since the collapse of the Soviet Union, U.S. policy makers have increasingly been seized with the problem of what can reasonably be done to lessen the risk of loss of control over former Soviet nuclear weapons. Moreover, the risk of theft or diversion of nuclear weapons, or a breakdown of the nuclear chain of command very probably will be greater for any new nuclear powers than for the present acknowledged nuclear weapons states. The costs and benefits of providing different levels of assistance to new nuclear powers to avoid a nuclear control breakdown should be assessed. Should a decision to provide such aid be taken, DoD's experience in ensuring physical security and personnel reliability in controlling nuclear weapons offers a source of insights, lessons, and know-how that could help a new nuclear power to maintain effective controls, but stop short of providing nuclear-weapons design information.

4.4.3. Design Credible Deterrence Posture.

The design and implementation of a credible posture to deter nuclear weapons use by new nuclear powers against U.S. forces or friends will be an especially important challenge for defense planners. Possible response options and force packages will have to be identified and assessed in terms of their likely effectiveness in deterring specific third world countries; force posture requirements to implement preferred options should be determined; and implications for declaratory policy explored. Ongoing regional analyses by DoD agencies for the CINCs could be drawn on in determining deterrence requirements in particular regions. The military services' expertise in targeting, the Defense Nuclear Agency's knowledge of weapons effects, and special technical assessments of alternative munitions would be useful in defining response options.

4.4.4 Disarming Hostile New Proliferators.

After the use of a nuclear weapon by a new proliferator, a decision might be made to attempt to disarm the proliferator. This would be a very demanding mission. DoD contingency planning is warranted to meet it. Accurate, detailed, and timely intelligence for use in targeting weapons systems, as well as effective vulnerability analyses, clearly would be essential. R & D on a suitable mix of advanced munitions and delivery systems to destroy the targets -- with acceptable collateral effects -- are also in order.

4.4.5 Protection and Defenses (for Allies, U.S. Forces, and CONUS).

DoD has the lead in devising active defenses, including mobile ATBMs, against new nuclear powers armed with ballistic missiles. A major DoD role will be continuing such R&D on ATBM systems in preparation for possible deployments. Precise assessments of the lethality of alternative kill mechanisms and the survivability of prospective ATBM systems in a nuclear environment are needed. Potential cooperative ATBM programs with key allies and friends (such as that with Israel) also warrant exploration.

Future situations may arise in which a new nuclear power attempts to smuggle a nuclear weapon into another country, possibly even giving warning after the fact that it had done so in an effort at blackmail. DoD planning should therefore include support for overseas nuclear searches for a clandestine nuclear weapon. DoD logistical support could be required, as well as the deployment of special operations forces.

4.4.6 Post-Use Aid.

In spite of the best efforts of the United States and others, one or more third world countries may resort to the use of nuclear weapons in a future conflict. DoD's expertise in nuclear medical and environmental effects -- as well as its overall logistics capabilities -- could well be called on in responding to the consequences of such use. The continuing Defense program of training physicians and medical support personnel, as well as the existing

reservoir of capability, could be invaluable in the treatment of casualties. These resources would also be valuable in the event of an accidental overseas detonation of a nuclear weapon.

APPENDIX A

USG AGENCY ROLES IN NUCLEAR NONPROLIFERATION POLICY

A.1 SCOPE.

With varying degrees of involvement, a number of U.S. Government agencies and the Congress play a role in nuclear nonproliferation policy. These agencies include the National Security Council (NSC); the Departments of Commerce, Defense, Energy, State, and Treasury; the Arms Control and Disarmament Agency (ACDA); the intelligence community;[1] the U.S. Nuclear Regulatory Commission (NRC); and several Congressional committees.[2]

A.2 EXECUTIVE BRANCH AGENCIES.

A.2.1 Department of Commerce (See Figure A-1).

The Commerce Department's Bureau of Export Administration (BXA) is the central agency responsible for coordinating and administering U.S. national security and foreign policy export controls, originally as mandated by the Export Administration Act (EAA) of 1979, as amended. The BXA develops export control policy, processes export license applications, and enforces U.S. export control laws.

The BXA oversees export licensing, technology and policy analysis, and determines whether controlled goods are freely available in other countries. The BXA, in consultation with the Department of Defense and other agencies, generates and administers the Commodity Control List (CCL), a list of dual-use commodities subject to Commerce export controls, and the Nuclear Referral List (NRL), a list of commodities requiring specific validated export licenses for nuclear nonproliferation reasons. The NRL was formalized in Section 309(c) of the Nuclear Non-Proliferation Act of 1978.

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[1]The Intelligence Community, although not included in this study, is also a very key player and tool for promoting and protecting U.S. nonproliferation policies in the nuclear weapons field, as well as in the other mass destruction weapon proliferation areas of concern. The growing importance of these issues and concerns, and the special role of the Intelligence Community, is evidenced in the fact that the Central Intelligence Agency established a special Nonproliferation Center (NPC) and the Defense Intelligence Agency has established organizations specifically charged with monitoring proliferation, world-wide.

[2]The information provided in this appendix was collected in August, 1993.

Specifically, the BXA licenses nuclear-related dual-use items and commodities "of significance for nuclear explosive purposes." The BXA is also the general export control authority for commodities, technology, and technical data, and for controls on exports for national security reasons.

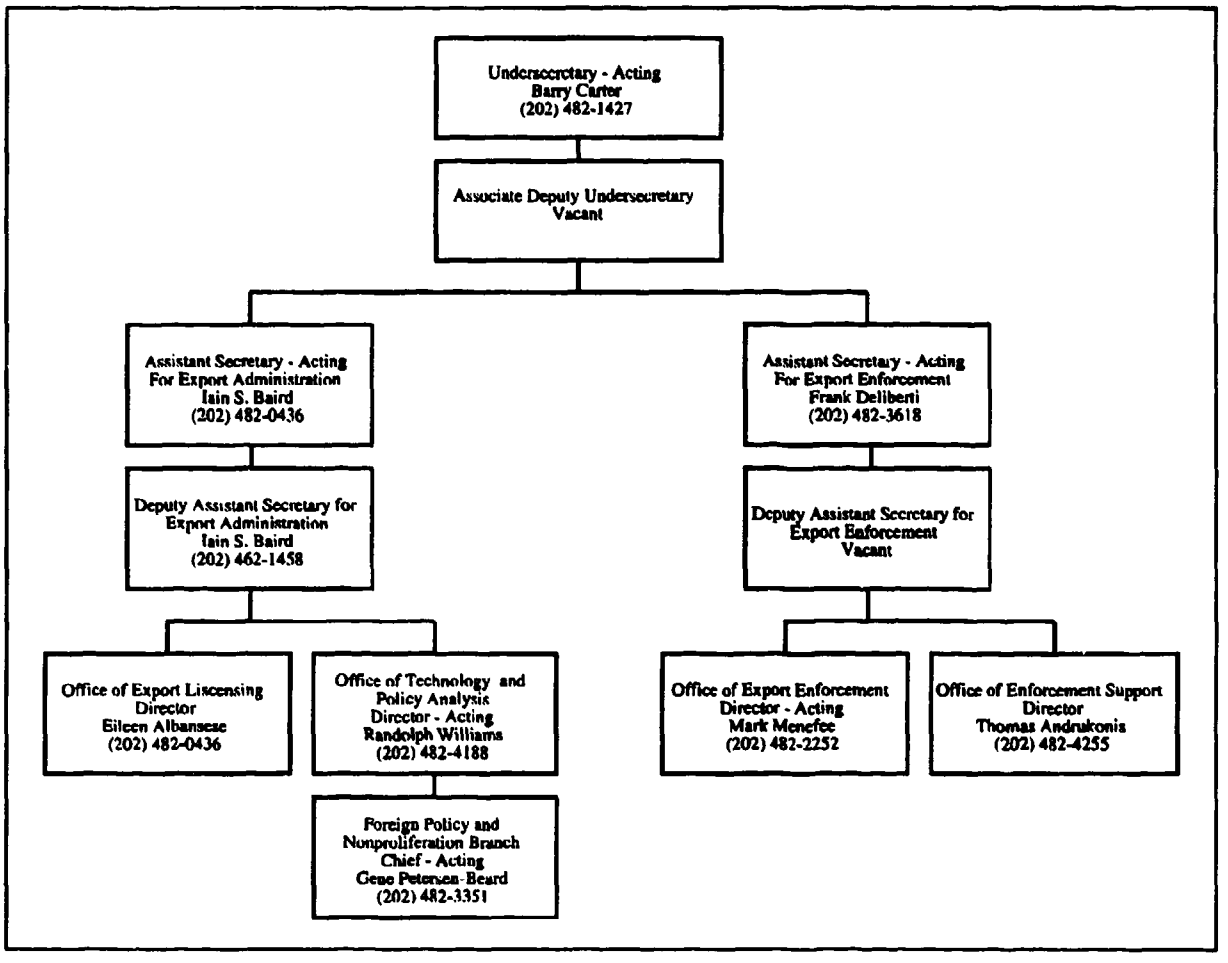

Figure A-1. Key nuclear nonproliferation offices at Commerce's Bureau of Export Administration.

Section 5(h) of the Export Administration Act (EAA) of 1979, as amended, created technical advisory committees (TACs) to advise and assist the executive branch in matters relating to export controls. Each of the ten TACs currently in existence consists of representatives of U.S. industry and various government departments and agencies.

A.2.2 Department of Energy (DOE) (See Figure A-2).

In the field of nuclear nonproliferation, the DOE controls "Restricted Data" which concerns design, manufacturing, or utilization of atomic weapons. DOE authorizes the provision of technical assistance and information on nuclear technology to other countries, and any subsequent arrangements for previously exported U.S. nuclear items.

The DOE is responsible for licensing unclassified assistance to foreign nuclear fuel cycle activities by U.S. persons who engage directly or indirectly in production of special nuclear material outside the United States. The Secretary has granted general authorization for certain activities, but other activities require specific authorization. A specific authorization is required to engage in activities in any foreign country, if the activities involve providing Sensitive Nuclear Technology[3] or providing certain types of assistance pertaining to reactors or facilities for: (1) the separation (enrichment) of isotopes of source or special nuclear material; (2) chemical processing of irradiated special nuclear material; (3) fabrication of nuclear fuel containing plutonium; or (4) production of heavy water. Specific authorization is also required from the Secretary for U.S. persons to engage directly or indirectly in the production of special nuclear material in countries of concern listed in Title 10, Code of Federal Regulations, Part 810.8.

[3]"Sensitive Nuclear Technology" includes both private and U.S. government-generated technology that is important to the design, construction, operation, or maintenance of a facility for uranium enrichment, nuclear fuel reprocessing, or heavy water production. Sensitive Nuclear Technology includes information that is not Restricted Data and not available to the public.

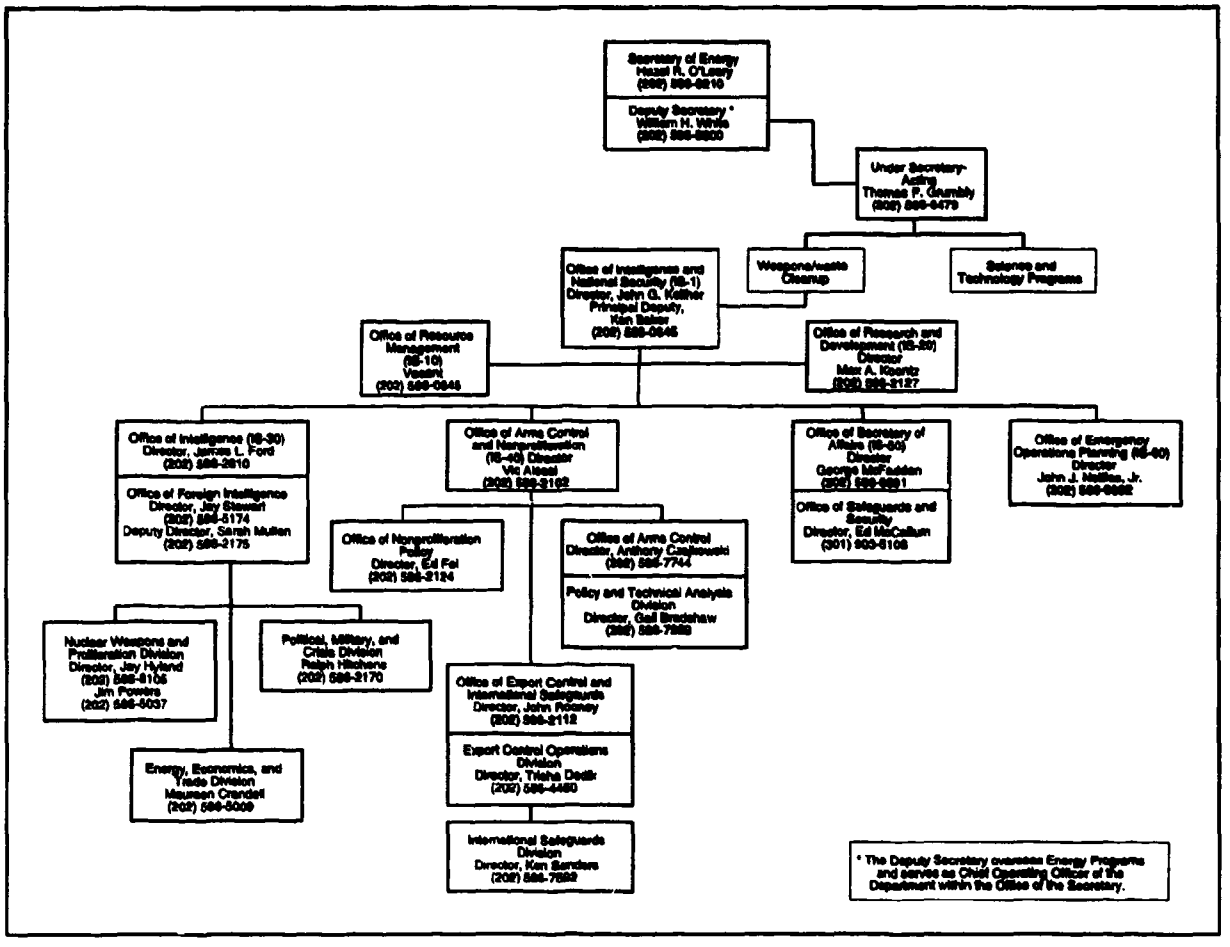

Figure A-2. Key nuclear nonproliferation offices at the Department of Energy.

The Office of Export Control and International Safeguards (OECIS) develops and implements the policies and regulations governing nuclear-related export controls. OECIS reviews and makes recommendations on nuclear and nuclear-related export cases licensed by Commerce, State, and the Nuclear Regulatory Commission, and maintains and updates lists of commodities and technology controlled for national security and nuclear nonproliferation reasons.

A.2.3 Department of State (See Figure A-3).

Senior level State Department oversight of nuclear weapons nonproliferation policy is centered in the Office of the Under Secretary for International Security Affairs, whose office is known by the acronym "T."

State/T receives nonproliferation policy support from the Assistant Secretary for Politico-Military Affairs (PM), and from relevant regional and functional bureaus. Richard T. Kennedy, Ambassador-at-Large and Special Advisor to the Secretary on Nonproliferation Policy and Nuclear Energy Affairs, retains special responsibility for nuclear nonproliferation issues and U.S. relations with the IAEA.

The State Department's Bureau of Oceans and International Environmental and Scientific Affairs (OES), which includes the Office of Export and Import Control, the Office of Nonproliferation and Export Policy, and the Office of Nuclear Technology and Safeguards, is involved in nuclear export control and nonproliferation policy issues. Within OES, the Office of Export and Import Control has responsibility for reviewing export license applications for items controlled by the Nuclear Regulatory Commission.

Other State Department offices involved in nuclear nonproliferation policy include: the Office of CoCom Affairs within the Bureau of Economic and Business Affairs (EB); and the Office of Proliferation of Nuclear Weapons (PNW), the Office of Strategic and Theater Policy (STP), and the Center for Defense Trade (CDT), all within the Bureau of Politico-Military Affairs (PM). The Office of Strategic and Theater Policy is involved in strategic arms control issues, including nuclear testing policy, the START negotiations, and the Cooperative Threat Reduction (CTR) program. PM's Center for Defense Trade (specifically, the Office of Defense Trade Controls), guided by the International Traffic in Arms Regulations (ITAR), has authority to license exports of arms, ammunition, implements of war, and technical data. Several ITAR categories concern specialized nuclear equipment, technology, and materials, and proposed exports in these categories are referred to the Department of Energy for review and recommendations.

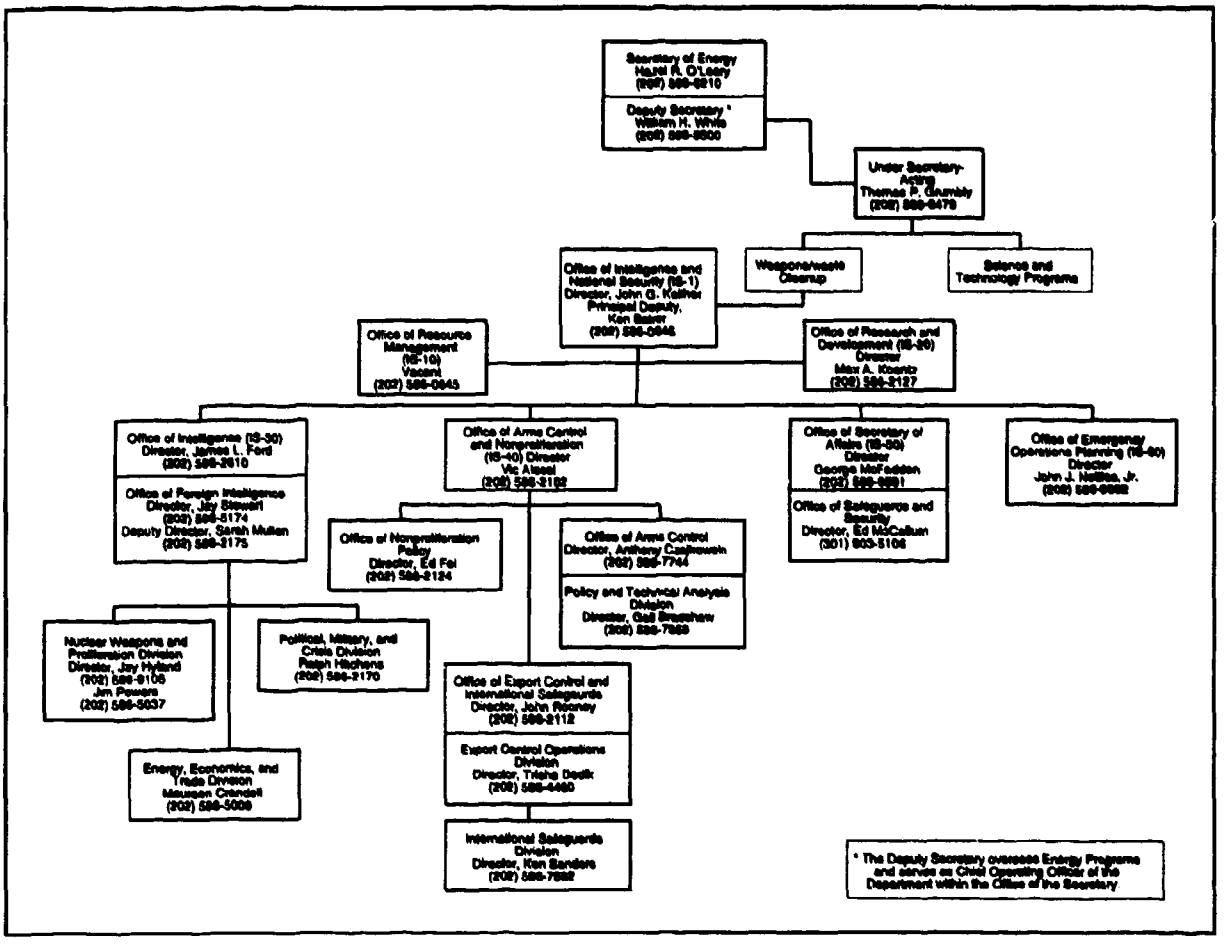

Figure A-3. Key nuclear nonproliferation offices at the Department of State.

USD/P receives support directly from the Assistant Secretary for International Security Affairs (ISA), and the Deputy Assistant Secretary for Nonproliferation Policy (NPP), which are DoD's lead offices on nuclear and other proliferation issues. Additional policy support is provided by the Assistant Deputy Under Secretary for Policy Planning.

DoD's day-to-day supervision of nuclear export control issues is delegated by the Deputy Under Secretary of Defense for Trade Security Policy (DUSD/TSP) to the Defense Technology Security Administration (DTSA). Section 10 (g) of the EAA gave DoD a consulting role in license review, and a 1985 executive order gave DTSA review responsibility for certain dual-use exports to non-controlled destinations that may pose a risk of diversion to a proscribed destination. This role in export enforcement is limited to analysis of data, and, if necessary, subsequent interaction with the Commerce Department's Bureau of Export Administration.

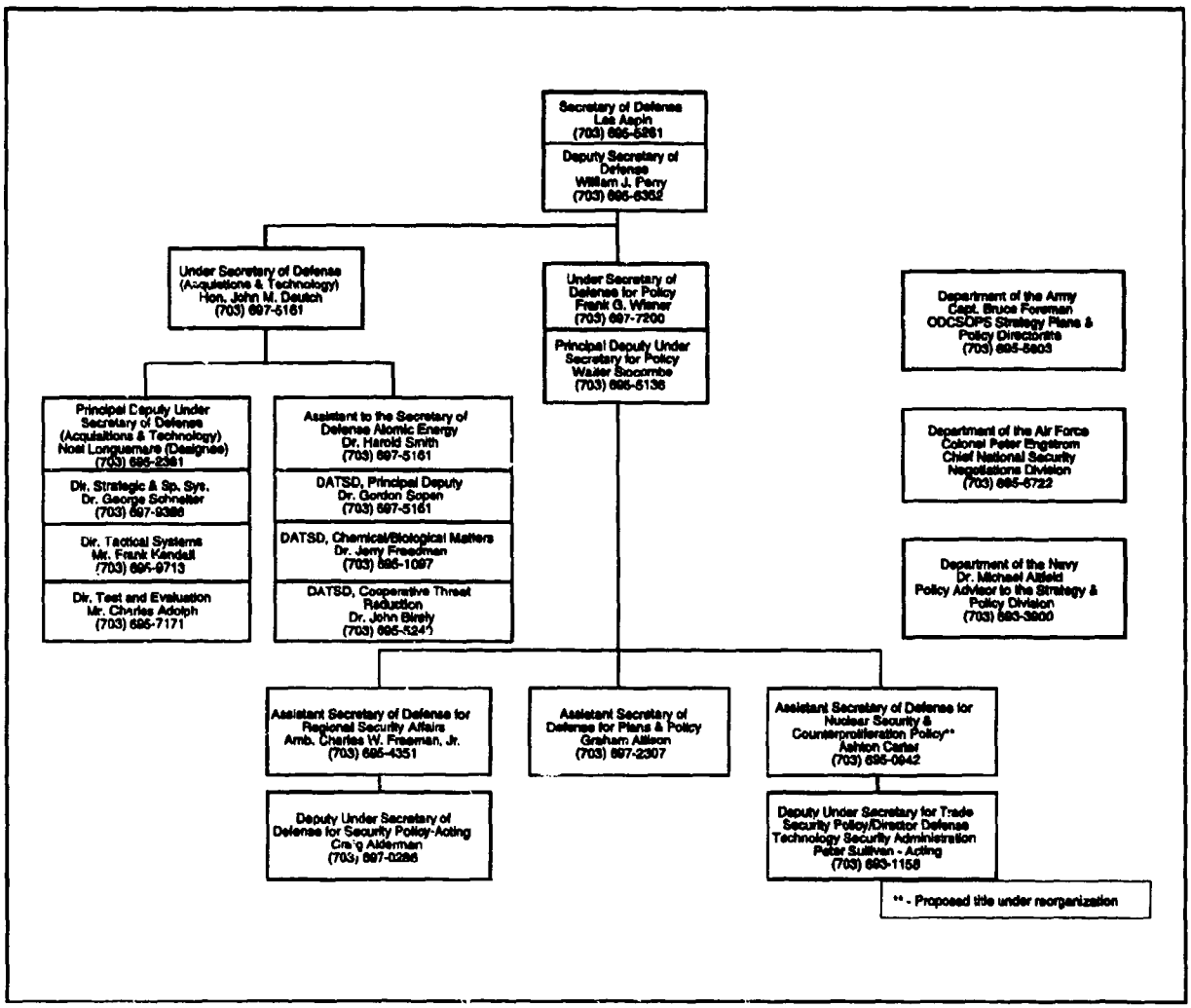

Figure A-4. Key nuclear nonproliferation offices at the Department of Defense.

A.2.5 Department of Treasury (See Figure A-5).

The Treasury Department administers transaction control regulations (TCR). TCRs explicitly apply to merchandise whose unauthorized export from the United States is prohibited by regulations issued under the Atomic Energy Act of 1954, i.e., NRC regulations in 10 CFR 110 and DOE regulations in 10 CFR 810. A Treasury license would be required for any export to a Treasury-controlled destination even if NRC or DOE had already licensed the transaction.

TCRs vary for each country and circumstance, and are an important nonproliferation tool. One of the functions of TCRs is to freeze the U.S. assets of designated countries until specific U.S. objectives are achieved. Another objective is to control exports.

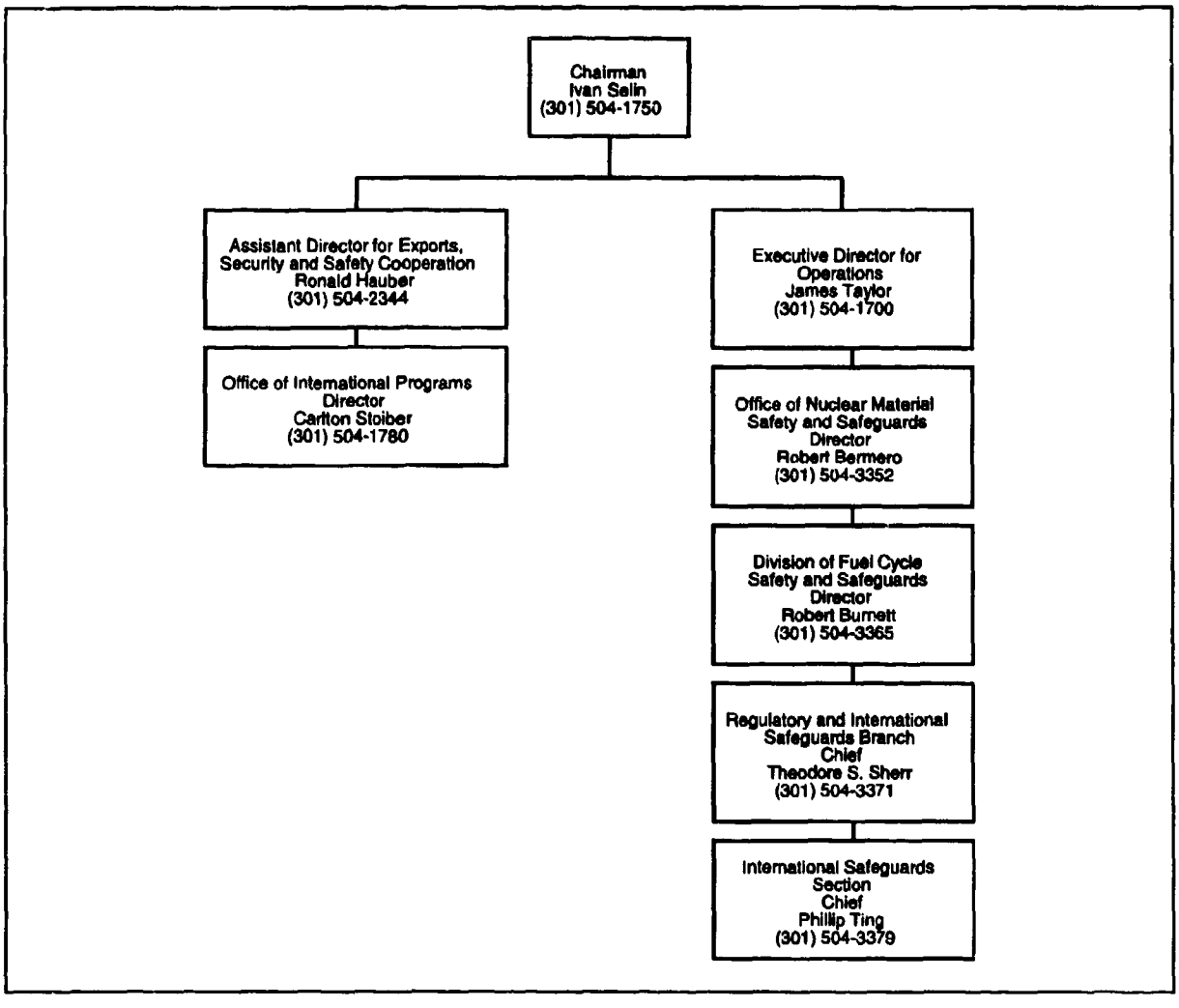

Figure A-5. The Office of Foreign Assets Control at Treasury.

The Treasury Department's Office of Foreign Assets Control (OFAC) administers sanctions or trade restrictions imposed by the President under the Trading with the Enemy Act (TWEA). OFAC controls all financial and trade transactions with Cuba, Cambodia, Iraq, Libya, North Korea, and Vietnam. OFAC also controls certain specific transactions with Zimbabwe, Nicaragua, Panama, the former Soviet Union, and China.

A.2.6 Nuclear Regulatory Commission (NRC) (See Figure A-6).

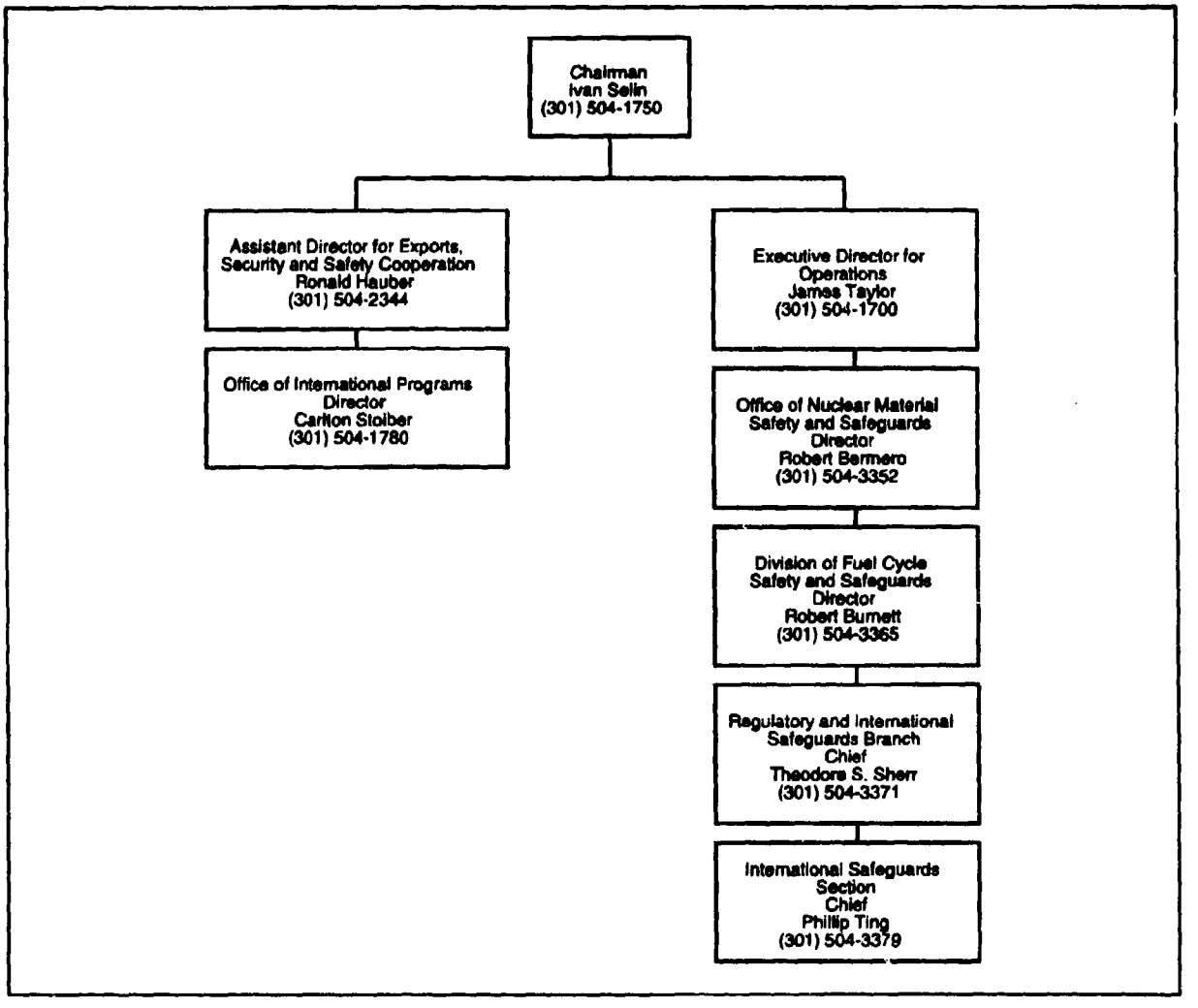

Figure A-6. Key nonproliferation offices at the Nuclear Regulatory Commission (NRC).

The NRC licenses nuclear research, power plants, special equipment and materials, and items associated with nuclear reactors. Specifically, the NRC's Office of International Programs, with technical assistance from the Office of Nuclear Material Safety and Nuclear Safeguards, licenses the following materials:

- Special nuclear materials (plutonium, enriched uranium, and other materials as defined by the government);
- Source material (uranium, thorium, and other materials as defined by the government);
- Byproduct material (e.g., material made radioactive by exposure incident to production or use of special nuclear material);
- Production and utilization facilities (equipment and devices capable of producing or using special nuclear material in such quantity as to be "of significance" to defense and security, or any "important component part especially designed" for such equipment or devices); and
- Items or substances "especially relevant from the standpoint of export control because of their significance for nuclear explosive purposes" (including "component parts" of production and utilization facilities).

A.2.7 Arms Control and Disarmament Agency (ACDA) (See Figure A-7).

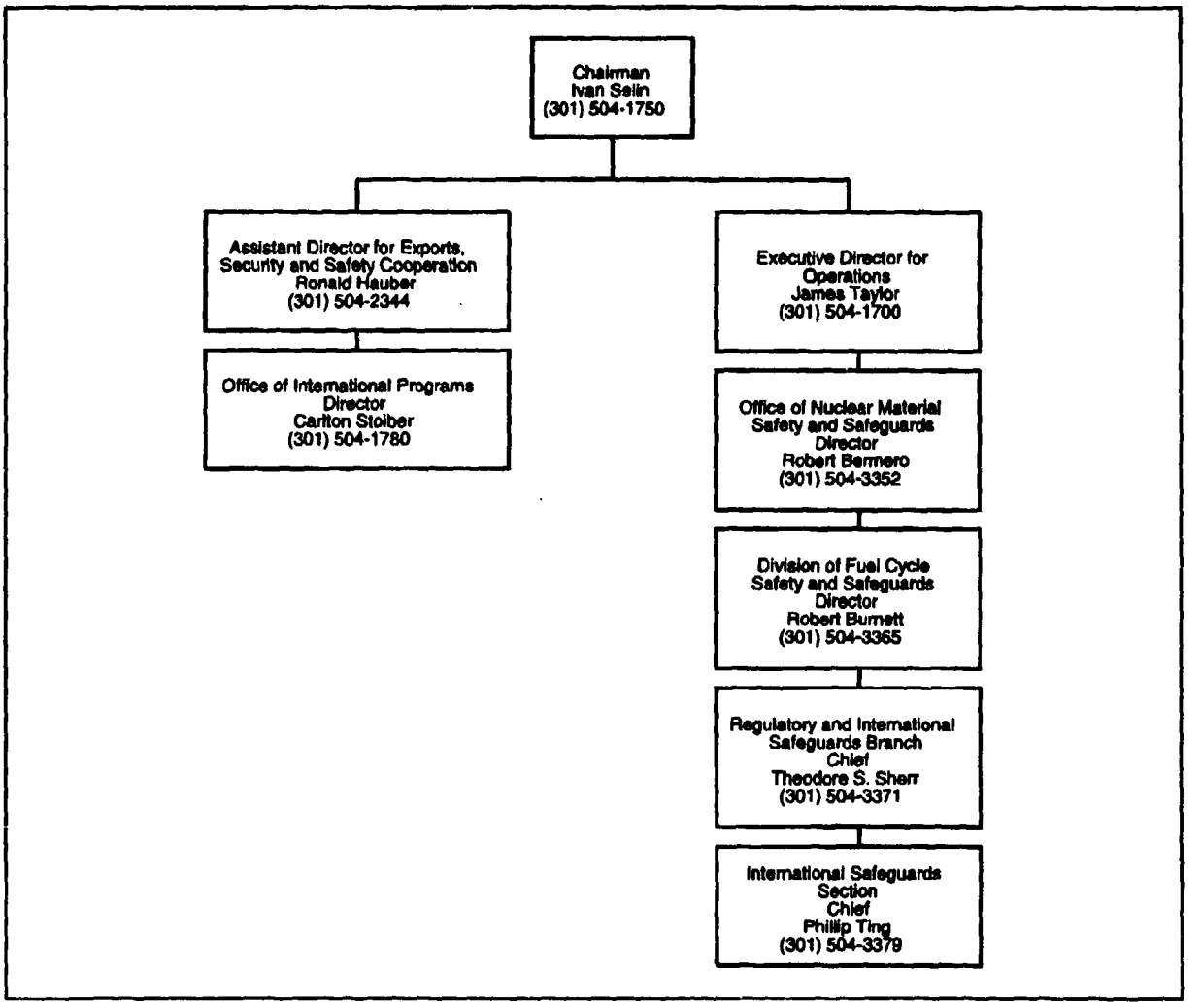

Figure A-7. Key nuclear nonproliferation offices at ACDA.

ACDA's arms control and disarmament mandate encompasses nuclear nonproliferation. Specifically, ACDA helps manage U.S. participation in negotiations related to the NPT. It also conducts and coordinates research on proliferation topics; helps verify compliance with existing agreements; monitors arms transfers worldwide; and engages in international negotiations on nuclear safety.

A.2.8 National Security Council (NSC) (See Figure A-8).

Within the NSC, Interagency Working Groups (NSC/IWGs) are the senior interagency fora for consideration of issues affecting defense, arms control, nonproliferation, and technology transfer policies. The objective of these Assistant Secretary-level groups (on which State, Defense, Commerce, Energy, and other agencies, as required, are represented) is to develop recommendations on policy issues for National Security Council consideration.

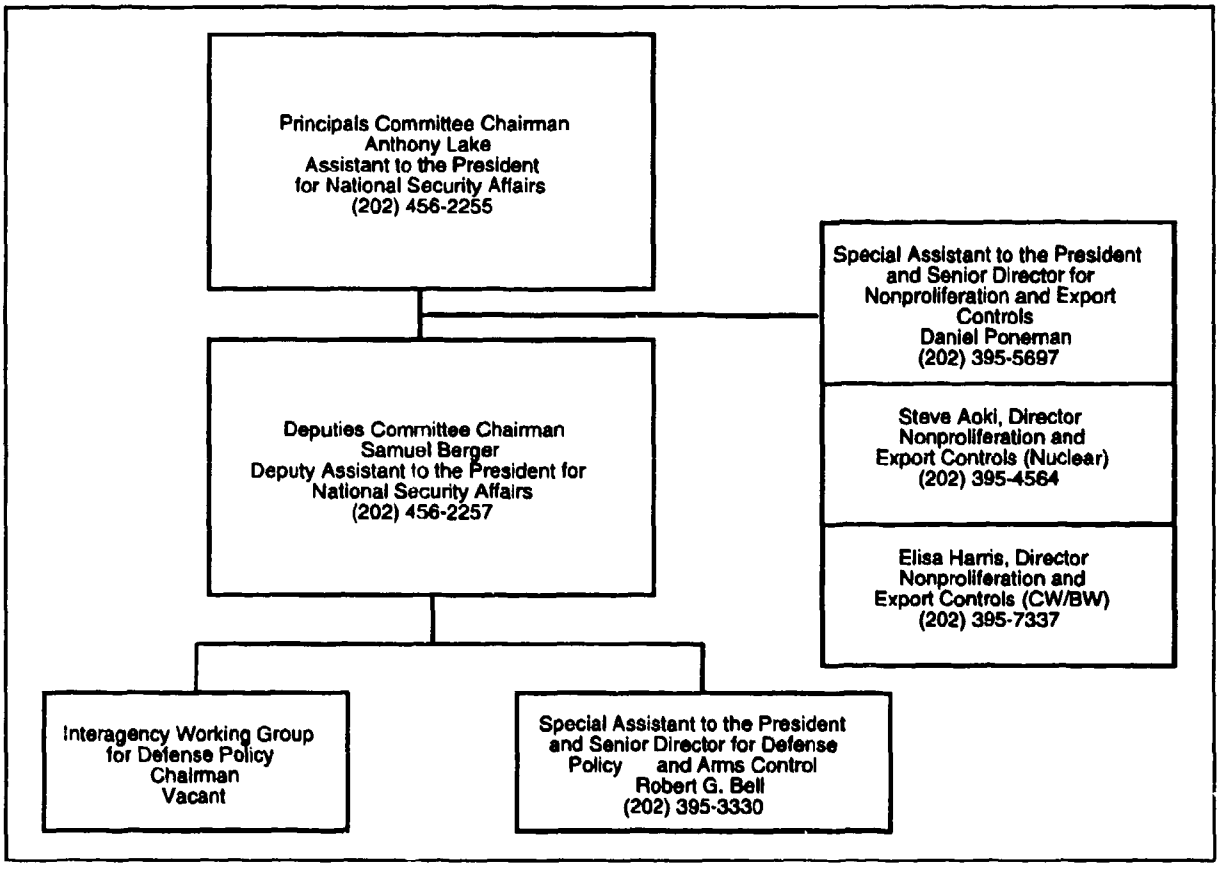

Figure A-8. NSC Interagency Working Groups.

The Nonproliferation Interagency Working Group deals with trade issues relating to the spread of nuclear weapons, as well as with the proliferation of chemical and biological weapons and missile delivery capabilities.

A.2.9 The Joint Staff (See Figure A-9).

Within the uniformed military, the Joint Staff of the Joint Chiefs of Staff (JCS) coordinates with the military services to develop JCS policy on arms control and proliferation issues. Within the Strategic Plans and Policy Directorate (J-5), the Weapons Technology Control Division is responsible for nonproliferation issues. It consists of the Chem/Bio Weapons Branch and the Nonproliferation Branch.

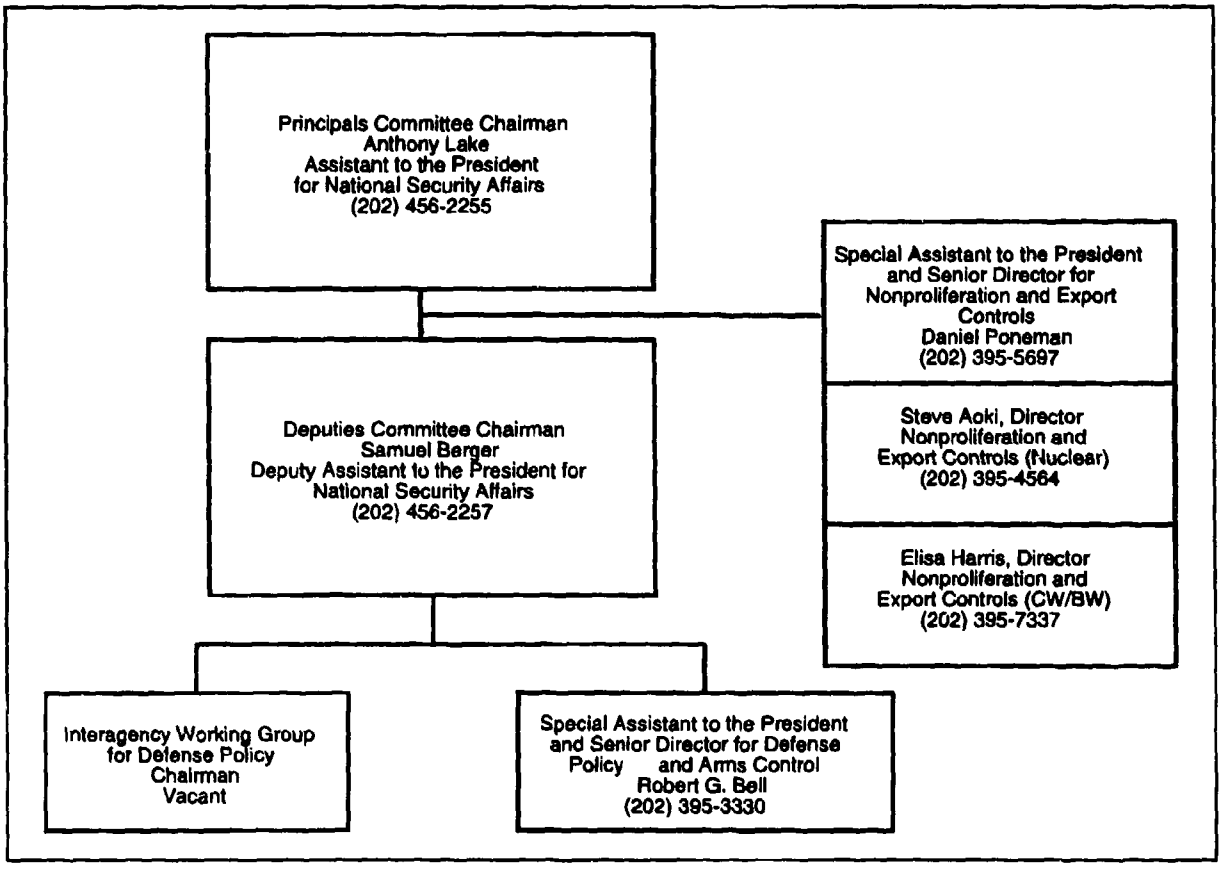

Figure A-9. Key nuclear nonproliferation offices within the Joint Staff.

A.3 INTERAGENCY CONSULTATIVE MECHANISMS.

A.3.1 Subgroup on Nuclear Export Coordination (SNEC).

The SNEC is an interagency forum that, among other things, monitors and reviews export licensing activities of the NRC and U.S. Government transfers undertaken by DOE, pursuant to Agreements for Cooperation authorized by Section 123 of the Atomic Energy Act of 1954, as amended. The Subgroup serves as a forum for exchanging and coordinating views among the member agencies, namely, the Departments of State, Commerce, Defense, and Energy, the Nuclear Regulatory Commission, the Arms Control and Disarmament Agency, and the national intelligence agencies, (in particular the Central Intelligence Agency and the Defense Intelligence Agency).

The SNEC was created to coordinate implementation of the Nuclear Non-Proliferation Act of 1978. State's Bureau of Oceans and International Environmental and Scientific Affairs chairs the Subgroup, and Energy performs the Secretariat function. SNEC is purely an advisory body, and is not authorized to perform any statutory responsibilities of its member departments or agencies. In export license review cases, SNEC forwards its recommendations to Commerce, and disputes within SNEC are forwarded to the National Security Council's Nonproliferation Policy Coordinating Committee.

A.3.2 Export Administration Review Board.

The Board is a senior export policy review group composed of the Secretaries of Commerce (acting as chair), State, Defense, and Energy, and representatives of other agencies as required. The most senior export advisory group within the Executive Branch, it meets occasionally to consider major export policy issues affecting national security and nuclear nonproliferation.

A.4 THE CONGRESS.

A.4.1 Overview.

The Congressional role in nuclear nonproliferation policy is expressed through legislation, Senate advice and consent for treaties, hearings, and investigations.

All proposed agreements for nuclear cooperation and subsequent agreements must be submitted to Congress for a period of 90 days of continuous session. During the first 30 days, the President is required to consult with the Senate Committee on Foreign Relations and the House Committee on Foreign Affairs regarding the consistency of the agreement with the requirements of the Atomic Energy Act (AEA), Section 123. Thereafter, a joint resolution may be introduced, and Congress has 60 additional days of continuous session in which to hold hearings and act on the resolution. The resolution is required to say that the Congress does or does not favor the proposed agreement for cooperation (AEA, Sections 123 and 130).

If the President determines that an agreement meets all the statutory requirements, it automatically takes effect after the 90-day review. However, the Congress can reject a Presidential approval by a joint resolution of disapproval, assuming it can override a Presidential veto. If the President waives any requirement of the Act, the agreement can take effect only if both Houses pass a resolution of approval.

A.4.2 The Senate (See Figure A-10).

The functions of the Senate committees and subcommittees primarily involved in nuclear nonproliferation issues are summarized below:

- The Committee on Armed Services: all matters relating to national security;
- The Committee on Foreign Relations: all matters relating to foreign policy and national security;
- The Committee on Governmental Affairs: all matters relating to oversight of government agencies; and
- The Committee on Environment and Public Works' Subcommittee on Nuclear Regulation: all matters relating to the nonmilitary regulation and control of nuclear energy.

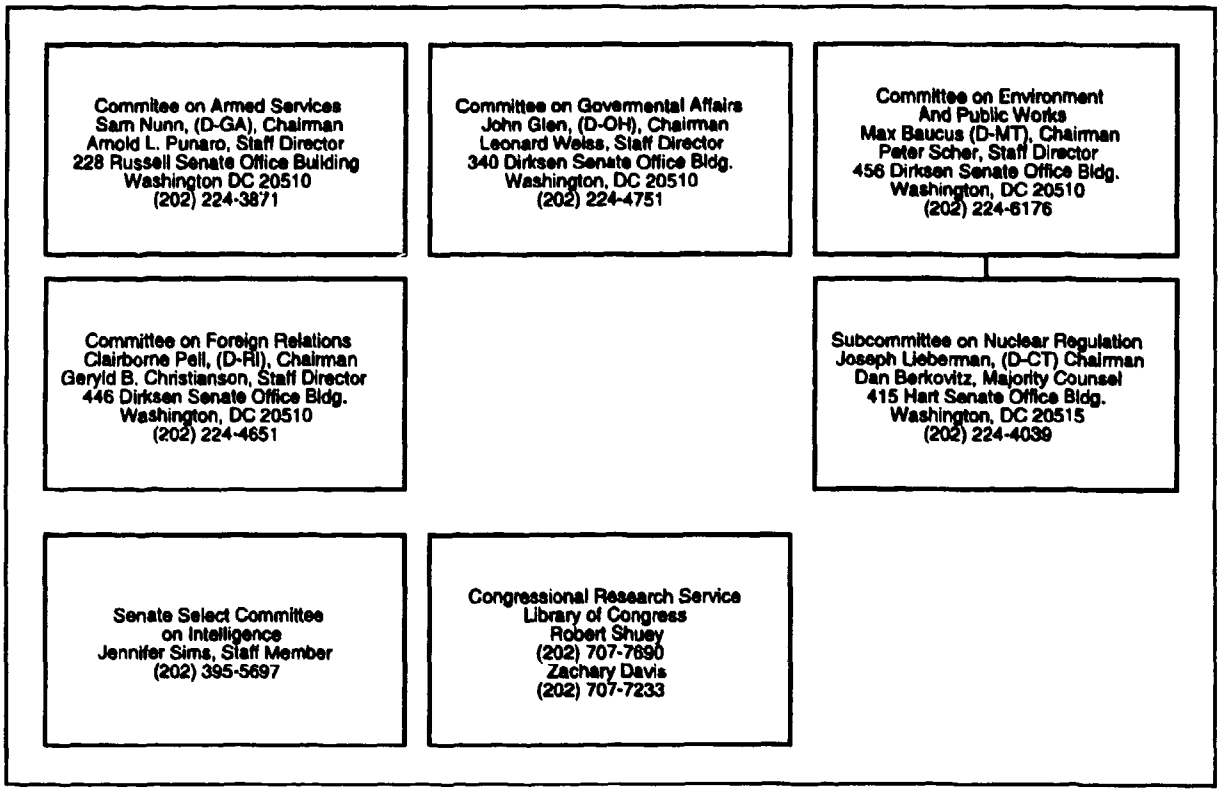

Figure A-10. Senate Committees involved in nuclear nonproliferation.

A.4.3 The House of Representatives (See Figure A-11).

- The Committee on Armed Services: all matters relating to strategic and critical materials, military applications of nuclear energy, and international arms control and disarmament;

- The Armed Services Subcommittee on Procurement and Military Nuclear Systems: all matters pertaining to the military application of nuclear energy, including related research and development, and intelligence matters of national security concern with related legislative oversight. The subcommittee also has oversight responsibilities with regard to international arms control and disarmament;

- The Committee on Foreign Affairs: all matters relating to export controls, including nonproliferation of nuclear technology and nuclear hardware; and international commodity agreements, including all agreements for cooperation in the export of nuclear technology and nuclear hardware;

- The Foreign Affairs Subcommittee on Arms Control, International Security and Science: all matters relating to national security and developments affecting foreign policy; the Arms Control and Disarmament Agency and all aspects of arms control and disarmament; the security aspects of nuclear technology and materials; and oversight of State and Defense Department activities involving arms transfers, arms export licenses, administration of security assistance, arms sales, foreign military training and advisory programs, and conventional arms control;

- The Foreign Affairs Subcommittee on International Economic Policy and Trade: all matters relating to export administration; and

- The Committee on Science, Space and Technology's Subcommittee on Energy: all matters relating to nuclear energy research and development projects, including civilian nuclear waste, environmental restoration and waste management, space power, magnetic fusion, and advanced reactor systems.

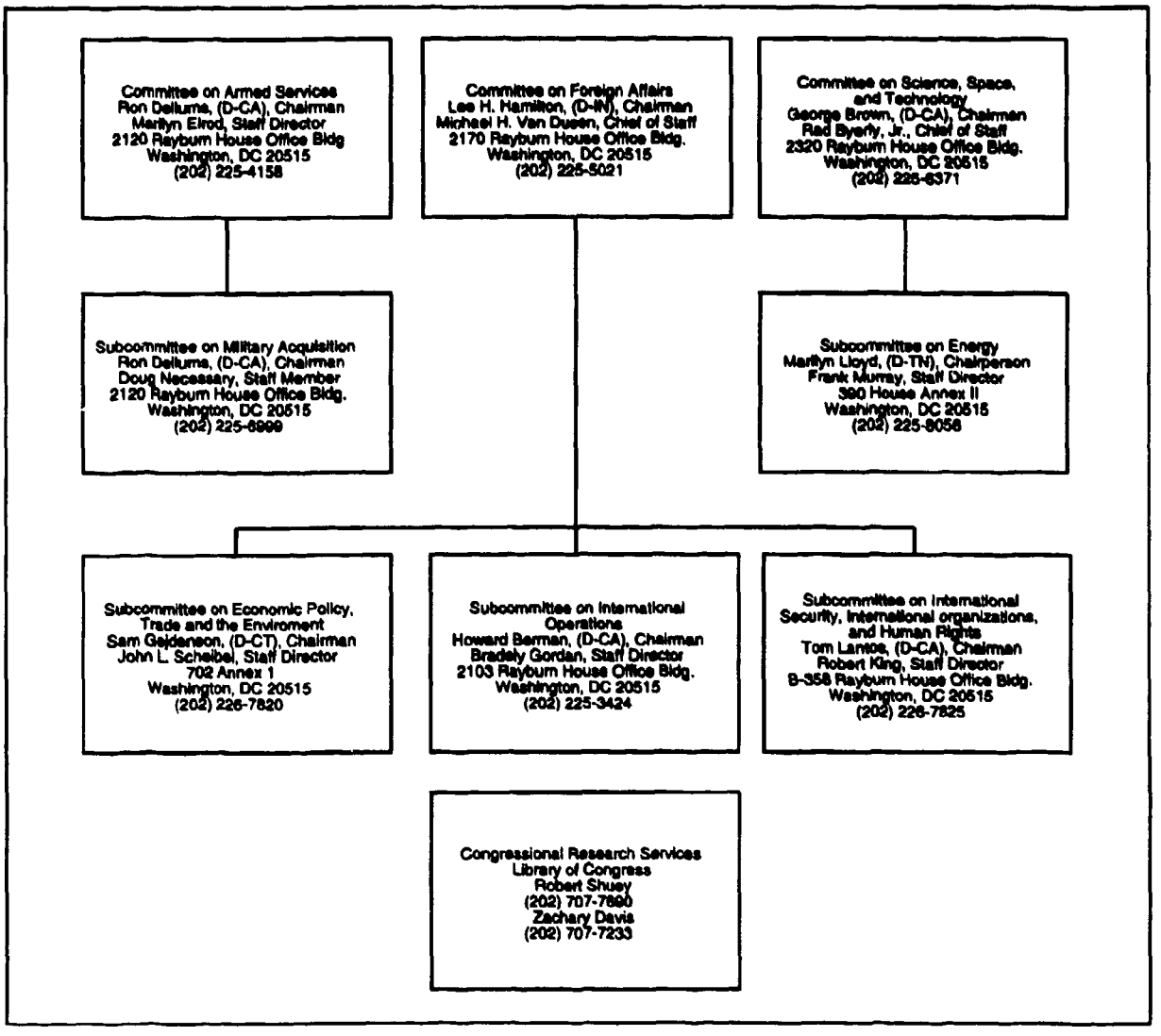

Figure A-11. U.S. House committees involved in nuclear nonproliferation.

APPENDIX B

LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS

A

AA-2D	Designation for Soviet produced air-to-air missile
ABM	Anti-ballistic missile
AC	Hydrogen cyanide (blood agent)
ACDA	Arms Control and Disarmament Agency
ACEP	Advisory Committee on Export Policy
AEC	Atomic Energy Commission
AECA	Arms Export Control Act
AEW	Airborne Electronic Warfare
AFRRI	Armed Forces Radiobiology Research Institute
AG	Australia Group
AGNI	Name of Indian produced medium-range ballistic missile
AIM-9D	Designation for U.S. produced air-to-air missile
ALCM	Air-launched Cruise Missile
ARMSCOR	South Africa's Armaments Corporation
ASW	Anti-Submarine Warfare
ATBM	Anti-tactical ballistic missile
AT&T	American Telephone & Telegraph

B

BDA	Battle Damage Assessment
BDRP	Biological Defense Research Program
BEAR	NATO designation for TU-142 bomber
BTW	Biological and toxin warfare
BW	Biological warfare; biological weapons
BWC	Biological and Toxin Weapons Convention; Biological Weapons Convention

BWS	Biological weapons state
BXA	Bureau of Export Administration [Department of Commerce]
BZ	Quinuclidinyl benzoate (psychochemical or hallucinogen)

C

C3	Command, control, and communications
CANDU	Canadian deuterium-uranium (reactor)
CB	Chemical and Biological
CBM	Confidence-building measure
CBW	Chemical and biological weapons; chemical and biological warfare
CBU	Cluster bomb unit
CCL	Commodity control list
CD	[Geneva] U.N. Conference on Disarmament
CDC	Centers for Disease Control
CDT	Center for Defense Trade (Department of State)
CEP	Circular error probable
CFE	Conventional Forces Europe
CFR	Code of Federal Regulations
CG	Phosgene (choking agent)
CGIAR	Consultative Group on International Agriculture Research [Institutes]
CHEMEX	Chemical Exchange
CIA	Central Intelligence Agency
CINC	Commander in Chief
CINCs	Commanders in Chief
CK	Cyanogen chloride (blood agent)
CL	Chlorine (choking agent)
CN	Chloroacetophenone (tear gas)
COCOM	Coordinating Committee [for Multilateral Export Controls]
CONUS	Continental United States
CRDEC	[U.S. Army] Chemical Research, Development, and Engineering Center

CRS	Congressional Research Service, Library of Congress
CS	Orthochlorobenzylidene malononitrile (a type of tear gas)
CSCE	Conference on Security and Cooperation in Europe
CSS-2	Designation for Chinese designed intermediate-range ballistic missile
CW	Chemical warfare; chemical weapons
CWC	Chemical Weapons Convention
CX	Dichloroformoxime (also phosgene oxime, a skin irritant)

D

D_20	Deuterium oxide [heavy water]
DARPA	Defense Advanced Research Projects Agency
DISAM	Defense Institute of Security Assistance Management
DEC	Digital Equipment Corporation
DM	Adamsite (a type of tear gas)
DMZ	Demilitarized Zone
DNA	Defense Nuclear Agency; Deoxyribonucleic acid (genetic material)
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOS	Department of State
DP	Diphosgene (choking agent)
DRSA	Defense Relations and Security Assistance Office (Department of State)
DSAA	Defense Security Assistance Agency (DOD)
DTC	Defense Trade Controls Office (Department of State)
DTP	Defense Trade Policy Office (Department of State)
DTSA	Defense Technology Security Administration
DUSD/I&IPD	Deputy Under Secretary of Defense for Industrial and International Programs
DUSD/TSP	Deputy Under Secretary of Defense for Trade Security Policy

E

EAA	Export Administration Act
EAR	Export Administration Regulations
ECI	Export-controlled information
ECWG	Expert Control Working Group
EDAC	Economic Defense Advisory Committee
EFA	European Fighter Aircraft
EMIS	Electromagnetic isotope separation
EPCI	Enhanced Proliferation Control Initiative
ERINT	Extended Range Intercept Technology

F

F-117	Designation for U.S. designed and produced stealth aircraft fighter/bomber
FAA	Foreign Assistance Act (1961)
FAO	Food and Agricultural Organization
FLANKER	NATO designation for SU-29 aircraft
FMS	Foreign Military Sales
FSX	Designation of Japanese Advanced Fighter Program
FULCRUM	NATO designation for MIG-29 aircraft
FY	Fiscal Year

G

GA	Chemical nerve agent - tabun
GAO	General Accounting Office
GATT	General Agreement on Tariffs and Trade
GB	Chemical nerve agent - sarin
GD	Chemical nerve agent - soman
GDP	Gross Domestic Product
GPALS	Global Protection Against Limited Strikes

GPS	Global positioning system
GRIPEN	Name of Swedish designed and produced aircraft

H

HAFT (I & II)	Name of Pakistani missiles developed from French rockets
HD	2-chloroethyl sulphide (distilled mustard blister agent)
HD	Chemical nerve agent - mustard
HEU	Highly enriched uranium
HFAC	House [of Representatives] Foreign Affairs Committee
HPT-32	Designation for Indian produced high performance training aircraft

I

ICAO	International Civil Aviation Organization
IAEA	International Atomic Energy Agency
ICBM	Intercontinental ballistic missile
ICSU	International Council of Scientific Unions
IEEPA	International Emergency Economic Powers Act (1977)
IGMDP	[India] Integrated Guided Missile Development Program
IIL	International Industrial List [on dual-use items and technology]
IMF	International Monetary Fund
IMU	Inertial Measuring Unit
INR	[Bureau of] Intelligence and Research
INS CHAKRA	Indian Naval ship "Chakra"
IRBM	Intermediate-range ballistic missile
ISA	[Assistant Secretary of Defense for] International Security Affairs
ISRO	Indian Space Research Organization
ITAR	International Traffic in Arms Regulations
ITC	International Trade Commission
IWG	Interagency Working Group

J

JCS	Joint Chiefs of Staff

K

KFP	Korean Fighter Program
KG	Kilogram
KM	Kilometer

L

L	Lewisite (arsenic-based blister agent)
LANCE	Name of U.S. produced short-range ballistic missile
LAVI	Name of Israeli developmental fighter aircraft
LEU	Low enriched uranium
LIC	Low intensity conflict
LIS	Laser isotope separation
LTV	Name of U.S. Defense Contractor (Link Tempco Vaught)

M

M-9	Designation of Chinese ballistic missile
M-11	Designation of Chinese ballistic missile
MCTL	Military Critical Technologies List
MDE	Major defense equipment
MDW	Mass destruction weapons
MIG-27	Designation for Soviet designed combat aircraft
MIRV	Multiple independently-targeted reentry vehicle
MIT	Massachusetts Institute of Technology
ML	Munitions List (Department of State)
MLF	Multilateral Force
MLRS	Multiple launch rocket system(s)
MOX	Mixed oxide

MTAG	Missile Trade Analysis Group
MTCR	Missile Technology Control Regime
MTEC	Missile Technology Export Control

N

NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NIH	National Institutes of Health
NIKE	Name of U.S. developed surface-to-air missile
NNWS	Non-Nuclear Weapons State(s)
NO-DONG	Designation for North Korean intermediate-range ballistic missile now under development
NPT	Nuclear Non-Proliferation Treaty (Refers to the 1968 Treaty on the Non-Proliferation of Nuclear Weapons
NRC	Non-recurring cost recoupment; Nuclear Regulatory Commission
NSC	National Security Council
NSF	National Science Foundation
NSG	Nuclear Suppliers Group
NSDD	National Security Decision Directive
NTM	National technical means [of reconnaissance]
NWS	Nuclear Weapons State(s)

O

OFAC	Office of Foreign Assets Control (Department of the Treasury)
OPANAL	Organization for the Prohibition of Nuclear Weapons in Latin America
OPEC	Organization of Petroleum Exporting Countries
OSD	Office of the Secretary of Defense
OTA	[U.S. Congress] Office of Technology Assessment
OTRAG	Acronym for German-owned Zaire-based rocket manufacturer

P

PAL	Permissive action link
PCC	Policy Coordinating Committee
PERSHING	Name of U.S. produced ballistic missiles
PIP	Product Improvement Program
PM	[Assistant Secretary of State for] Political Military Affairs
PNE	Peaceful nuclear explosion
PRITHVI	Name of Indian ballistic missile currently under development
Pu	Plutonium
Pu-239	Fissile isotope of plutonium
Pu-240	Non-fissile isotope of plutonium

Q

Q	2-chloroethylthio (blister agent)

R

RCA	Riot control agents (chemical)
R&D	Research and development
RDT&E	Research, Development, Test, and Evaluation
ROK	Republic of Korea (South Korea)
RV	Reentry vehicle

S

SAIC	Science Applications International Corporation
SAM	Surface-to-air missile
SAPRWG	Security Assistance Program Review Working Group
SCUD	NATO nickname for Soviet designed short-range ballistic missile
SDI	Strategic Defense Initiative [U.S.]
SIPRI	Stockholm International Peace Research Institute
SLBM	Submarine-launched ballistic missile

SLV	Space launch vehicle
SNF	Strategic Nuclear Force
SNM	Special nuclear material
SNT	Sensitive nuclear technology
SONDA IV	Name of Brazilian developed ballistic missile
SRBM	Short-range ballistic missile
SRT	Strategic Relocatable Target
SS-21	Designation for Soviet designed short-range tactical ballistic missile
SS-23	Designation for Soviet designed mobile intermediate-range ballistic missile
SSM	Surface-to-surface missile
START	Strategic Arms Reduction Talks [Treaty]

T

T	2-chloroethylthioethyl (blister agent)
TAC	Technical Advisory Committee (Department of Commerce)
TCR	Transaction Control Regulation (Department of the Treasury)
TDG	Thiodiglycol chemical precursor for mustard gas
TEL	Transporter-Erector-Launcher
TGD	Chemical nerve agent - thickened soman
THAAD	Theater High Altitude Air Defense
THOMSON CSF	Name of French defense contractor
TTG	Technical Task Group (Department of State)
TW	Toxin warfare
TWG	Technical Working Group (Department of Defense)

U

U-235	Fissile isotope of uranium
U-238	Non-fissile isotope of uranium
UAV	Unmanned aerial vehicle
UCNI	Unclassified controlled nuclear information
UK	United Kingdom

UN	United Nations
UNEP	United Nations Environmental Program
URENCO	European multinational corporation involved in uranium enrichment
US	United States
USA	United States Army
USAF	United States Air Force
USAMRIID	U.S. Army Medical Research Institute of Infectious Diseases
USD/P	Under Secretary of Defense for Policy
USG	United States Government
USN	United States Navy
USS	United States Ship [Navy]

V

VR-55	Soman-based nerve agent
VX	Category of chemical nerve agent

W

WHO	World Health Organization
WMD	Weapons of mass destruction
WMEAT	World Military Expenditures and Arms Transfers (ACDA)

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SUBJECT: DOCUMENT CHANGES

The Defense Threat Reduction Agency Security Office reviewed the following documents in accordance with the Deputy Secretary of Defense Memorandum entitled, "Department of Defense Initiatives on Persian Gulf War Veterans' Illnesses" dated 22 March 1995, and determined that the documents were unclassified and cleared for public release:

DNA-TR-93-84, AD-B244408, Acoustic Resonance Spectroscopy in CW Verification Tooele Field Trial (August 1992).
DNA-TR-93-129-V1, AD-B192045, Global Proliferation – Dynamics, Acquisition Strategies and Responses, Volume 1 – Overview.
DNA-TR-93-129-V2, AD-B192046, Global Proliferation – Dynamics, Acquisition Strategies and Responses, Volume 2 – Nuclear Proliferation.
DNA-TR-91-216, AD-B163637, Harmonizing the Chemical Weapons Convention with the United States Constitution.
DNA-TR-92-180, AD-B175230, Evaluation of the Concept of a List for the BWC.
DNA-TR-92-61, AD-B167663, Basic State Party Functions and Skills Under CWC.
DNA-TR-92-66, AD-B167357, Domestic Reporting Requirements for Chemical Industry.
DNA-TR-91-213, AD-B163260, Analysis of the Interactions Between Treaties.
DNA-TR-93-70, AD-B177262, Chemical Weapons Convention Inspections of Private Facilities Application of United States Environmental and Safety Laws.
DNA-TR-92-182, AD-B173450, Commercial Products from Demilitarization Operations.
DNA-TR-91-217-V3, AD-B169350, Chemical Weapons Process Parameters, Volume 3 – Users' Guide.
DNA-TR-92-116-SUP, AD-B175292, Technical Ramifications of Inclusion of Toxins in the Chemical Weapons Convention (CWC), Supplement.
DNA-TR-92-128, AD-B175452, Task 1 Report Target Vapor Identification and Database Development.
DNA-TR-92-196, AD-B174940, Task 2 Report Algorithm Development and Performance Analysis.
DNA-TR-93-68, AD-B178109, CW Detection Instrument R&D Design Evaluation.

Enclosed is a copy of the referenced memorandum. If you have any questions, please call me at 703-325-1034.

Ardith Jarrett

ARDITH JARRETT
Chief, Technical Resource Center